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Worker participation in the prevention of musculoskeletal risks at work

Report

European Agency for Safety and Health at Work

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Table of contents

List of figures, tables, and boxes

Executive summary

Introduction

The negative impact of work-related musculoskeletal disorders (MSDs) on the health of workers and on the productivity and costs of business is significant. It is essential to tackle MSDs. Workers need to participate in an effective way to address this major burden. They are key to identifying MSD risk factors and the prevention solutions that will work in practice. Managers do not have the solutions to all health and safety problems. Workers who do the tasks and their representatives have the detailed knowledge and experience of how the job is done and how it affects them.

This report offers insights into how workers themselves can contribute to identifying hazards and developing meaningful solutions. The report presents 22 of the most appropriate participatory methods to prevent MSDs based on evidence. Participatory methods are activities that enable workers to play an active and influential part in decisions that affect their jobs. It includes 48 short examples and 9 more in-depth case studies from workplaces on the use of worker participation in preventing MSDs. It provides an analysis and discussion of the success factors and guiding principles for worker participation, and includes policy pointers and good practice tips for micro and small enterprises (MSEs).

The examples cover the most important employment sectors in the EU, with a few additions from overseas countries. They also cover a variety of company sizes and different worker groups, such as men and women and skilled and unskilled workers.

In the report, participation refers to the participation of those who perform work activities, using a problem-solving approach to reduce risk factors. Participation covers, in principle, all levels of hierarchy who may have first-hand experience about the specific problem. It may include both direct worker participation and worker representatives. (Kuorinka, 1997; Van Eerd et al., 2010).

Methodology and classification of worker participation approaches in MSD prevention

The information that follows is based on international scientific literature found on worker participation in MSD prevention, complemented with additional material on the internet, researcher networks and EU-OSHA focal points.

Workplace MSD prevention interventions should progress through a series of steps or phases. Ideally, workers should participate in each phase:

- Assess risks to identify issues that need to be addressed.
- Generate solutions to identify and develop possible solutions.
- Implement solutions that cover the practical application of the solution.
- Perform evaluations to inform whether solutions are working.
- Integrate into operations to secure the sustainability of the solutions.

The report categorises the methods and examples based on the phases they are used in, and whether worker participation is used in all the phases (holistic and whole-system approaches), some (multi-phase methods), or only one (single-phase measures).

Choosing a participatory method

Table 1 presents an overview of the methods included in the report.

Whole-system approaches are the most comprehensive, but usually require more resources and professional assistance to apply them. In some cases, it can be easier to adapt the methods to the specific context by combining a series of single-phase or multi-phase tools. This makes the process simpler, but will require more planning. For example, dialogue meetings or forum groups can be the basic method for most of the worker participation across the whole process to solve a relatively simple MSD problem, such as introducing basic lifting aids (a hoist or a lift). Assessing the risks and generating solutions can take place at dialogue meetings with workers, where responsibility for implementing the selected solution is delegated. A new dialogue meeting can then be used to evaluate and (later) discuss how to integrate into operations.

Dialogue meetings are also an example of a method that can easily be applied to MSEs, while many other methods need considerable adaptation and/or external professional assistance to use in MSEs. Some methods have been used in broader occupational safety and health (OSH) issues and do not particularly target MSDs, but can easily be focused on MSD prevention. Other methods are drawn from fields such as lean manufacturing (kaizen and 5S) or OSH management systems (audits). By involving workers in their application, they can be used for MSD prevention. These methods have the advantage of already being applied in operations, making them potentially easier to integrate.

Table 1 Overview of methods included in the report

Holistic and whole-system approaches	Multi-phase methods	Single-phase tools
▪ The Healthy Workplace Participatory Programme ▪ ErgoPar ▪ SOBANE ▪ Participatory Macro-ergonomic Work Analysis and Design	▪ Focus groups with workers ▪ Democratic dialogue ▪ Photo safari/photo voice and work debate space ▪ Future workshop ▪ Dialogue meetings and group discussions ▪ Toolbox talks ▪ Training in risk assessment and solutions generation ▪ Goldilocks work principle ▪ 5s and kaizen	▪ Root cause analysis ▪ Body mapping, hazard mapping ▪ Observation checklists and Rapid Upper Limb Assessment (RULA) ▪ Self-confrontation with video ▪ Simulation ▪ Involving workers in workstation redesign ▪ Ambassadors and champions ▪ Engaging workers in testing solutions ▪ Participatory internal audits

Worker participation case studies

Nine cases were analysed, covering similarities and differences and focusing on what works in different circumstances. This was done to identify conditions and actions that are important for successful worker participation in MSD prevention. The nine cases are as follows:

- **Reorganisation of a carpentry workshop** in a regional authority resulted in reduced MSD risks, more efficient operations and more engaged workers. The intervention used a holistic participatory method and a future workshop and simulation.
- **Intervention in a kindergarten** resulted in a reduction of MSD risks and more balanced physical activities. Key elements of the approach were the workers prioritising the most important child-caring tasks and focusing on integration of solutions with these tasks.
- **Kitchen work** was analysed using a series of participatory workshops. The workers used visits to other kitchens to find inspiration for identifying MSD risks and possible improvements.
- **An agri-food company** organised a systematic four-year participatory process to prevent MSDs. Support from OSH professionals and management commitment at all levels formed the basis for both tangible improvements and the institutionalisation of a participatory preventive policy.
- **A PVC factory** involved workers in developing and testing trolleys to reduce MSD risk from heavy manual handling. It involved collaborative work teams, and different options for adaptations to equipment were considered, tried and adjusted in a gradual process. The

management used the successful experience to continue with more worker participation activities.

- **Hotel cleaning, linen and catering staff** participated in an MSD risk reduction project. Supported by a regional OSH organisation, the hotel trained volunteers as prevention coordinators who then used observation and discussion with co-workers to find practical solutions to problematic activities.
- **Pruning grapevines** constituted a risk for MSDs at a vineyard. Management and workers worked systematically to develop less hazardous work methods. They received support from an OSH professional to use video to document and analyse work methods before and after changes. Worker verification of the video assessments was a key feature.
- **Maintenance workers:** a manufacturer used video as a point of departure for workers to analyse and improve their work. Improvements were later tested with operations workers to control MSD risks of their work tasks, as well.
- **A boiler manufacturer** used focus groups for workers and a fault tree analysis to identify the causes of MSDs. The workers then became involved in identifying and implementing improvements.

Conditions, actions and principles important for success

The report identified various conditions, mechanisms and actions that are key to facilitating successful worker participation in MSD prevention. These are similar to those identified for other OSH risks. They include the following:

Alignment between core work operations and changes to prevent risks

The closer the improvements get to the daily operations, the greater the possibility for success, especially for the sustainability of changes. Integration can be strengthened by using workers' needs as the starting point. It can also be reinforced by having workers involved in both risk assessment and in testing and evaluation to ensure that the changes made are adapted to daily operations and adopted in practice.

Managerial commitment to MSD prevention and active worker participation

The active commitment of managers at all levels of MSD prevention and worker participation is essential. Management activities need to demonstrate trust by delegating responsibility to workers and participating in dialogue with them. Regarding commitment to participation, this needs to be reflected in a general workplace culture of open communication where workers are listened to and their concerns acted upon, where there are processes to make this happen and where mangers actively engage with their workforce. If managers do not actively facilitate participation, for example, in organisations with a top-down, command-control culture where management decides everything on their own, worker trust in management's intentions regarding their participation in an MSD prevention activity will be low, and engagement is likely to be limited. On the contrary, organisations that already have a general approach to engaging workers in change processes and decision-making will see the greatest benefits of worker participation in an MSD intervention.

Worker participation in all phases of intervention

For worker participation in MSD prevention to be effective, it cannot be limited to a single activity, such as hazard spotting as part of assessing risks or generating solutions. A proposed improvement to an identified risk only helps if it is implemented in practice, tested, refined and integrated in daily operations. Therefore, the participatory efforts need to consider the full risk management cycle where all phases must be accomplished to secure a successful result, including monitoring and evaluating implemented solutions.

Clear distribution of roles and responsibilities

Too often, managers are occupied with running the core operations, and workers do not believe that they have the necessary authority to take action. A clear distribution of responsibility is therefore crucial for the outcome of any worker participation initiative, and the roles of all parties need to be clear. In many cases, with the right support and training, workers have the capacity and competence to take

charge of a large part of the preventive efforts, sometimes indirectly through coordinators or champions. However, it must be clear how much decision-making authority they have and when management approval is needed. Furthermore, managers must not use that distribution of responsibility as an excuse to neglect their own responsibility in ensuring that decisions are taken and risks are successfully prevented in practice.

Allocation of sufficient time and budgetary resources

Resources include sufficient time and budget to carry out the process and implement the MSD prevention measures. This includes ensuring sufficient working time for workers to participate in all activities and act as coordinators or champions if these are used, as well as time and resources to provide any training or to contract outside experts.

The participating workers need sufficient time during working hours. Those with additional responsibilities, including worker representatives and coordinators, need more time. However, all workers must have the possibility to join meetings, test solutions and other relevant activities, including time for tasks, such as completing questionnaires.

Many changes require investment in adapting existing conditions or acquiring new equipment. There needs to be a commitment to making the necessary budget available for this at the start of the intervention.

Competences and external support

The necessary competences need to be available to both run the participatory process and be able to assess and select the relevant MSD preventive solutions. Training for all workers in risk assessment and MSD prevention measures are often relevant. Worker representatives and other key actors, such as champions or coordinators, may need more extensive training.

Especially for more complex problems, the assistance of an ergonomist or other OSH professional has proved to be important in supporting the start of an intervention through to the implementation of solutions that work in practice. They help to plan and initiate the process, facilitate dialogue activities, assess the viability of solutions, and can also take care of training. Larger companies often have their own OSH support. Access to external support, for example through regional accident insurance organisations, are available in some countries. Where external support is used, the activities must be tailored to and embedded in the workplace. Some external programmes featured in the report's examples ran a participatory MSD intervention with several MSEs at the same time.

Identify and include all stakeholders

Starting the participatory process in the right manner lays the foundation for strong achievements. A key point here is to involve all concerned workers and other internal stakeholders in the process. Late involvement may lead to resistance because the concerned workers may feel that their views have not been taken into consideration. This approach will also help to get the workers committed to getting involved in the whole process, ensuring that solutions are integrated into the core operations and used in practice. Furthermore, it is important to remember to involve other concerned stakeholders, for example maintenance workers, or at the solution testing phase, workers in other parts of production who could be affected by a change, but also resource persons such as production engineers and design units. The workers directly concerned and (trade union) worker safety representatives (where present) should both be involved in a complimentary way, for example by involving safety representatives in the overall planning and steering process. They are different avenues to be combined as effectively as possible.

Room for innovation

Worker participation in MSD prevention inevitably builds on innovation. Work methods, organisation and technology need to be adapted, or completely new methods or technology may need to be introduced. An important element in worker participation is to allow space for innovation. The cases show that learning from other workplaces served as an important inspiration to get started with developing new ideas. Similarly, some methods such as future workshops and photo safaris are useful because they particularly focus on opening the mind to new thinking.

Communication

Active and efficient communication is essential throughout all phases of the process, which includes dialogues among all involved stakeholders and communications through notice boards and electronic means.

Implementation and follow-up in practice

Generating solutions does not change anything without practical implementation. The most successful cases used a stepwise approach that includes immediate actions and longer-term actions, providing tangible results that can serve as stepping stones for the actions. Improved worker participation gained through a specific MSD intervention can lead to improved worker engagement in OSH overall for the organisation going forward.

Tips for small businesses

The report indicates which methods and intervention examples could be relevant for or adapted to MSEs. While MSEs have fewer resources than larger organisations, active worker participation is probably more widespread in MSEs because of the closer social relations between owner-managers and workers who work and communicate with each other daily. However, for many MSEs initiating a participatory MSD prevention programme may be overwhelming. However, building on the daily practice of working together and holding relatively simple dialogues or workshops, the process of involving workers in MSD prevention may not be so complicated.

MSEs need to ensure that they:

- **listen to workers'** concerns related to MSDs;
- **organise meetings** to identify problems and generate solutions;
- **identify** the most important suggestions;
- **allocate responsibility** for implementation;
- **test and refine** solutions;
- **embed changes in daily operations** and check they are applied in practice;
- **seek external advice** when necessary;
- **keep workers fully informed and involved** at all stages through daily contact and other communication means.

Discussion

The methods and examples presented in this report show that there is a wide variety of ways to include worker participation in MSD prevention. The general principles for successful participation outlined above need to be tailored to the particular context, in specific decisions about who to involve, their level of involvement in different intervention phases and how to involve them.

It should be obvious to *involve all workers concerned*, but this is not always easy. There may be many workers in an establishment, including those both directly and indirectly affected by a given problem. There are also managers and professionals to involve. Therefore, engaging as many workers as possible needs to involve a combination of direct and indirect participation.

To get the process working in practice, there may be *different levels of involvement* and *influence* related to the various intervention phases. Maybe all workers will be involved in assessing risks and proposing solutions, with fewer (as representatives) involved in testing and implementing solutions. And then, again, all workers could be involved in evaluating the implemented solutions. Whatever approach is used, management must be transparent about how much influence and responsibility are allocated to the workers. Otherwise, the process may backfire if workers feel that their concerns are not treated seriously.

Finally, decisions are needed about *project organisation*. A project manager or project champion should ensure that activities are planned, executed and completed. Using a combination of a project group of workers and a joint steering group of management and workers can be effective. A participatory MSD intervention should not be treated as a one-off exercise. Part of the process should be to integrate the participatory experiences into both on-going operations and future changes to support continuous MSD

prevention practices. This can be facilitated by a management strategy for involving workers and permanent structures such as OSH and cooperative committees.

Conclusion

All employers in the EU are required to consult their workers on OSH, including MSD prevention. In agreement with previous EU-OSHA reports and other authors, this report finds that going beyond passive consultation to active worker participation in all phases of an MSD intervention will lead to more successful prevention practice. It enables the real problems to be identified and the best solutions to be generated. It can be particularly helpful for finding simple, practical solutions. It also helps to strengthen worker commitment and engagement in their organisations in general. In addition, it is an approach that is good for both workers' health and for business.

The many different methods and the experience from the practical examples clearly indicate that there is not just one road to efficient worker participation. There are many different approaches. Methods and tools can be combined in various ways in the process of adapting to the particular workplace context. Factors such as sector and workforce composition (gender, skilled or unskilled, ethnicity and others) are all important in fitting the particular participatory process to the workplace. In particular, for MSEs, approaches need to be adapted to their particular context of limited resources in the form of management and time.

In summary, the key success factors include the following:

- Management commitment at all levels and active engagement.
- Adequate time and resources.
- Training in MSDs/ergonomics, risk assessment and prevention, and participatory methods.
- Workers *actively* involved in all stages of the intervention, from planning to evaluation, and including all relevant stakeholders.
- Effective communication.
- Embed improved participation from one intervention into continuing MSD management.

Policy pointers

The report proposes the following policy pointers to improve active worker participation in MSD prevention.

Further developing rules and guidelines for worker participation

It would be beneficial for authorities and social partners to agree on rules and guidelines for active worker participation that go beyond formal consultation. This includes guidance on how to involve vulnerable groups, such as migrant and gig economy workers, and women as well as men. This should be combined with awareness-raising about the importance of active worker participation.

Creating support systems

Professional support is important, and sometimes a prerequisite for a successful participatory MSD intervention adapted to the national and sector context. Expanding professional support with a focus on assistance to develop participatory competences in companies would therefore be important for more effective worker participation.

Training in participation

Introductory training in participatory methods is important, and its availability needs to be expanded in many countries and sectors. OSH professionals need competence in how to involve workers. Managers and workers need training in their roles and MSD hazards and prevention. Labour inspectors would benefit from inspection guidelines and training on worker engagement so that they can advise enterprises during their inspections.

Intermediaries to support the special needs of MSEs

MSEs need support to carry out participatory processes, which is most efficiently provided through sector-specific intermediaries. Practical support for interventions, for example provision of training or steering and intervention, and economic support are relevant because MSEs generally do not have the resources to pay for market-based OSH consultancies. An effective way can be to run an intervention with several MSEs from a sector at the same time. This will allow MSEs to learn from each other.

Funding

EU transnational funding schemes could be used to develop and transfer programmes and initiatives on worker involvement between Member States. Additional national and EU funding would be a valuable asset for progress in worker participation.

Further research and sharing good practice

Further research is needed concerning the prerequisites for effective worker representation and participation, effective methods for MSEs to be able to apply themselves, and how worker consultation and involvement could be achieved in new types of work, for example the gig economy and among vulnerable worker groups. Any existing good practices need to be shared between organisations and between Member States.

1 Introduction

This report is part of a larger project on musculoskeletal disorders (MSDs) and worker participation that includes an expert article on participatory ergonomics and MSDs (EU-OSHA, 2021a), an OSHwiki article on participatory ergonomics (Copsey S. et. al., 2021) an information sheet on body and hazard mapping (EU-OSHA, 2020) and links to resources as part of an MSD database (EU-OSHA, 2021b). These publications and resources, in turn, are part of a larger research activity on MSDs (EU-OSHA, 2021c). MSDs continue to be one of the most prevalent types of work-related health problems in Europe. Exhausting and painful body positions, exposure to repetitive movements, and carrying or moving heavy loads – all of these very common workplace risk factors potentially cause MSDs. The risk factors for work-related MSDs are multifactorial and an integrated approach is needed to identify the relevant risk factors in individual situations and manage the problem (See Box 1) (EU-OSHA, 2018; EU-OSHA, 2007).

Box 1 MSDs and their risk factors

Musculoskeletal disorders (MSDs) are impairments of bodily structures such as muscles, joints, tendons, ligaments, nerves, cartilage, bones and the localised blood circulation system. If MSDs are caused or aggravated primarily by work and by the effects of the immediate environment in which work is carried out, they are known as work-related MSDs.

MSDs can be caused by many different (combinations of) factors. These include not only physical factors (whereby mechanical load applied to the musculoskeletal tissues can cause MSDs), but also organisational and psychosocial ones.

Effective worker participation is key to identifying MSD risk factors and the prevention solutions that will work in practice. For example, a review by Oakman et al. (2019) found lack of understanding of the importance of worker participation to be one of six barriers to the effective implementation of interventions to prevent work-related MSDs. Managers do not have the solutions to all safety and health problems. Workers doing the tasks and their representatives have the detailed knowledge and experience of how jobs are performed and how this affects them. For this reason, workplaces in which workers actively contribute to safety and health often have a lower occupational risk level and accident rates (EU-OSHA, 2012a; EU-OSHA, 2017). This report offers insights into how workers themselves can contribute to identifying hazards and developing meaningful solutions. It presents a range of different participatory methods and includes short examples and case studies from workplaces of the use of worker participation in MSD prevention. It provides an analysis of the success factors for worker participation and includes policy pointers and good practice tips.

Participation can be defined in many ways. This report uses the tradition from participatory ergonomics, which refers to involving those performing the work activities in problem-solving (Kuorinka, 1997; Van Eerd et al., 2010). See Box 2.

Box 2 Definition of participatory ergonomics

Participatory ergonomics (PE) is an approach resulting from several trends: participation in society, organisation of production according to sociotechnical principles, and the development of ergonomics from 'micro' to 'macro'.

PE requires the participation of those performing the work activities using a problem-solving approach to reduce risk factors.

The participation is not limited to 'worker participation' nor to formal, representative participation. It covers, in principle, all levels of the hierarchy, inviting the participation of those who may have first-hand experience about the problem in question (Kuorinka, 1997; Van Eerd et al., 2010).

All employers in the EU must consult workers on occupational safety and health (OSH) by law (EU-OSHA, 2021e) (see Annex 1), but this is too often carried out in a passive way without active participation where workers are really engaged and involved in hazard identification and solution identification, implementation and monitoring. Full participation goes beyond consultation – workers and their representatives are also involved in making decisions (EU-OSHA, 2012b).

For successful MSD prevention, active worker participation is a key element for many good reasons:

- If workers are given the opportunity to participate in shaping safe work systems, then they can advise, suggest, and request improvements – helping to develop measures to prevent occupational accidents and ill-health in a timely and cost-effective manner.
- Workers know the MSD risks from their own body. They experience the bodily overexertion from their daily tasks, and they also know what can go wrong with the work process.
- Workers are experts concerning the practicalities of their work:
    - They will have ideas about how to improve work to reduce the risks of MSDs.
    - Solutions need to be feasible for workers during their daily work – if they interfere with job goals such as efficiency and quality, or introduce new problems, the solutions will be discarded.
    - Solutions only become sustainable when they are integrated into the routine operations, and workers know how to integrate solutions in practice.
- By getting involved in an issue at the planning stage, workers are more likely to identify the reasons for taking a particular action, help find practical solutions and comply with the end result.
- Participation increases motivation and meaning of work, contributing both to health and wellbeing, and to productivity and innovation. Related to this, more decision-making opportunities at work also improve mental and physical health.
- It is a part of modern working life to have influence on one's own life and work, and participation in MSD prevention is one important possible way to strengthen this influence.

EU-OSHA studies show that worker participation consistently appears as a key factor for the successful identification of problems and implementation of practical solutions, regardless of the size or type of workplace or type of problem (EU-OSHA, 2012c). Leka and Cox (2008) list seven key principles for workplace interventions, including that interventions should be developed using high levels of participation to ensure they are self-sustaining and improve uptake and effectiveness.

However, worker participation is not always easy to ensure in practice. Management and workers in many companies have positive experience with successful participation, but others have not tried or have failed to turn participation effectively into practice. One important reason is that occupational safety and health (OSH) measures, including MSD prevention, may be pushed aside due to the focus on core business goals and the operations to achieve these goals. The daily fight to solve ad hoc problems to keep operations running fills the attention of both managers and workers.

Another important reason is limited knowledge about practical methods for worker participation. There are many issues to consider before and during worker participation activities, and if some of these issues are neglected or the wrong steps taken, the participation may fail. It is not because worker participation in MSD prevention is particularly difficult, but as with everything else it is important to get an idea about how to start and then to build up and reflect on experience. Among the important questions to consider for worker participation are:

- Whom to involve (all of those directly affected, representative workers)?
- How to involve workers (meetings, questionnaires, interviews, simulations)?
- What to involve workers in (risk assessment, solutions generation, implementation, evaluation)?
- How much influence (comments, suggestions, decisions, approval)?
- When to involve (planning, execution, follow-up, feedback)?
- How to organise (temporary work group or semi- or full permanent structures for participation)?

Not all of this needs to be decided before the first step. It is often good to start in a trial-and-error way, but at certain points in time, answers need to be found. Sometimes they evolve from practice and sometimes a clear decision needs to be taken – preferably with cooperation between management and workers. After all, participation is about talking together, which can be simplified to a few essential points (EU-OSHA, 2012b):

- Talk to one another.
- Listen to each other's concerns.
- Look for and share views and information.
- Discuss issues in good time.
- Consider what everyone has to say.
- Make decisions together.
- Trust and respect each other.

EU-OSHA (2012b) also points out that using a combination of arrangements and methods, both formal and informal, is usually best and that direct worker participation and worker representatives should not be seen as alternatives, but as different avenues to be combined as effectively as possible.

However, if it continues to be unclear how and when participation takes place, the possibility for a successful outcome diminishes with time, and the experience can be quite different for managers and workers. Perhaps managers believe that they are involving workers, but the workers do not share the experience of being involved, so they will slowly become disillusioned and lose their engagement in the process.

The purpose of this report is to provide inspiration and guidance for increasing worker participation in MSD prevention. It is hoped that employers and workers as well as their organisations (both employers' associations and labour unions), together with other stakeholders, can use the report to strengthen worker participation and implement the needed MSD prevention.

Medium-sized and larger enterprises have the advantage of access to more human resources – often including ergonomists and other OSH professionals. By using the personnel resources, they can organise the participatory processes, and many methods, tools and examples presented in this report have been applied in larger enterprises. However, larger enterprises also have a long decision chain, which may hamper the possibility for fast action, and the distance between executive levels and workers may be too great. Micro and small enterprises (MSEs) have an advantage as they typically have close social relations and the distance from workers to a management decision is short (see also Walters et al., 2018a). MSEs therefore often have an inclination toward worker participation, which can be used in MSD prevention. In the selection of methods, tools and case studies, priority was given to examples relevant for MSEs and reflections on how they can be adapted to the MSE context are provided.

Chapter 2 provides an overview of 22 methods and approaches to worker participation that have been tested in practice to actively involve workers in MSD prevention. A few of the methods cover the whole MSD risk prevention process, from the first risk assessment to the final evaluation and integration into daily operations. The majority have a more limited scope with a particular focus on one stage of the prevention process, such as how to facilitate participatory dialogue in risk assessment. Thus, the 22 methods are not necessarily mutually exclusive. The idea is to be inspired by the range of possibilities and even to facilitate the combination of methods where this could be useful. All method descriptions are supplemented with links to user guides, scientific articles, and case descriptions of implementation in practice.

Chapter 3 covers 48 practical case descriptions, many of which involve the application of methods presented in chapter 2. The case descriptions should serve as inspiration for initiating similar activities in other workplaces. The cases cover many different sectors, groups of workers and methods, so it will be possible for most readers to find an example that resembles their own particular work setting.

Chapter 4 provides extensive analyses of nine MSD prevention programmes with worker participation as a key element. The presentation of these cases focuses on the characteristics of effective worker participation by trying to answer the basic question: what works for whom under what circumstances? The chapter ends with a cross-case comparison of the conditions that supported or facilitated successful participation in these nine examples, where the results are translated into 13 basic conditions for effective worker participation in MSD prevention.

Chapters 5 and 6 build on conditions to summarise the basic principles for all companies and in particular MSEs respectively.

The report concludes with a discussion in chapter 7 of the considerations behind initiation and implementation of worker participation and provides suggestions to policy-makers for ways to strengthen worker participation in MSD prevention.

Workers are the experts and, given appropriate knowledge, skills, tools, facilitation, resources and encouragement, they are best placed to identify and analyse problems and to develop and implement solutions which will be effective in reducing injury risk and improving productivity, and be acceptable (Brown, 2005; Oakman et al., 2019).

2 Worker participation methods for MSD prevention

2.1 Introduction to the worker participation circle

This chapter presents 22 methods for worker participation in MSD prevention. The methods represent a wide range, from very simple tools that can be applied almost instantly without much prior training and preparation, to more comprehensive methods that can guide a whole process from the first risk assessment to the integration in operations and final evaluation, but also require much more preparation and planning. Some methods were originally developed for reasons other than worker participation in MSD prevention, but they have since been adapted and applied for this purpose.

Improvement of MSD prevention through worker participation, in many cases, requires a combination of several methods where the company moves from identification of risks and solutions to implementation, and further to integration in operations and evaluation. Sometimes it is possible to identify and implement an improvement immediately, but in most cases, it is a longer process to select the most effective solution, implement it and secure its sustainability. A few methods cover the whole process, while others need to be combined with other methods to complete the process. Most of the holistic methods define a process to be followed to obtain worker engagement, but do not specify exactly which job analysis or hazard assessment methods to use; thus, although they are comprehensive in terms of proceeding through all steps or phases, their application may entail bringing in single-phase methods such as observational checklists or focus groups. In turn, some of the single-phase methods, such as observation checklists and RULA, are not participatory per se, but are simple enough to use that they can easily be incorporated into any participatory programme.

MSD prevention should follow a systematic approach: identifying risk factors, assessing the risks, identifying solution options and deciding which to implement, implementing the solution(s) (including setting priorities and drawing up an action plan), monitoring and evaluating the solutions and reviewing the process. Workers should be involved in all these stages. The report uses a method wheel (see figure 1) to illustrate the logical progression from risk assessment to solution generation and implementation, to evaluation and integration into operations. For each method described below, green markings in the wheel indicate where in the process the method fits best. A blue marking is therefore also a suggestion for where to consider supplementing the method as it misses some elements of the whole process. Furthermore, the wheel indicates that participatory MSD prevention is a cyclic exercise. Most often it is necessary to work continuously with MSD prevention and when one activity is completed, there will be a need to follow up with more preventive activities – also because old solutions may fade away or new technology require a new risk assessment and subsequent activities.

One step not shown in the wheel is that of engaging top management to support worker involvement in an OSH effort. This is an essential pre-condition (see Box 3) which is explicitly provided for in some holistic methods (HWPP, ErgoPar, MEAD) but merely assumed in others. Even when not stated explicitly, this step still needs to be carried out, either informally or by borrowing a strategy from a method which provides a prototype. Depending on who initiates the OSH effort (in-house ergonomist or other OSH professional, middle management, union representative, outside researcher, and so on), there will typically be one or more meetings for orientation and negotiation of the programme scope. This is likely to entail some assessment of organisational needs and resources, formally or informally. It is acknowledged in some methods but left implicit in others. An essential element in management commitment is to follow up. When a participatory process has been started, there must also be a willingness to follow it through to an end result, otherwise workers will be discouraged, and the workplace may be worse off than before the participatory attempt. Furthermore, if the workplace is conflict-ridden or the management have a strong resistance to certain solutions, the selection of tools can be difficult. Solution of the conflicts may need attention before participation will work, and management needs to make clear the limits for participatory actions and suggestions rather than let the workers imagine that every solution is possible.

Box 3 Management commitment

Essential requirements for worker participation include: Commitment of management to ensure there are adequate resources, both financial and personnel. Middle managers need to be committed and this needs to be sustained across the duration of the program to ensure both the uptake and engagement by workers with the program and to ensure the sustainability of any changes made. (Oakman et al., 2019).

Besides securing management support, an important element in preparing a participatory MSD preventive activity is ensuring that workers are provided with the opportunity to actively participate. For example, it must be clear that workers have the possibility to participate in meetings and other activities within their working hours.

Figure 1 Worker participation cycle

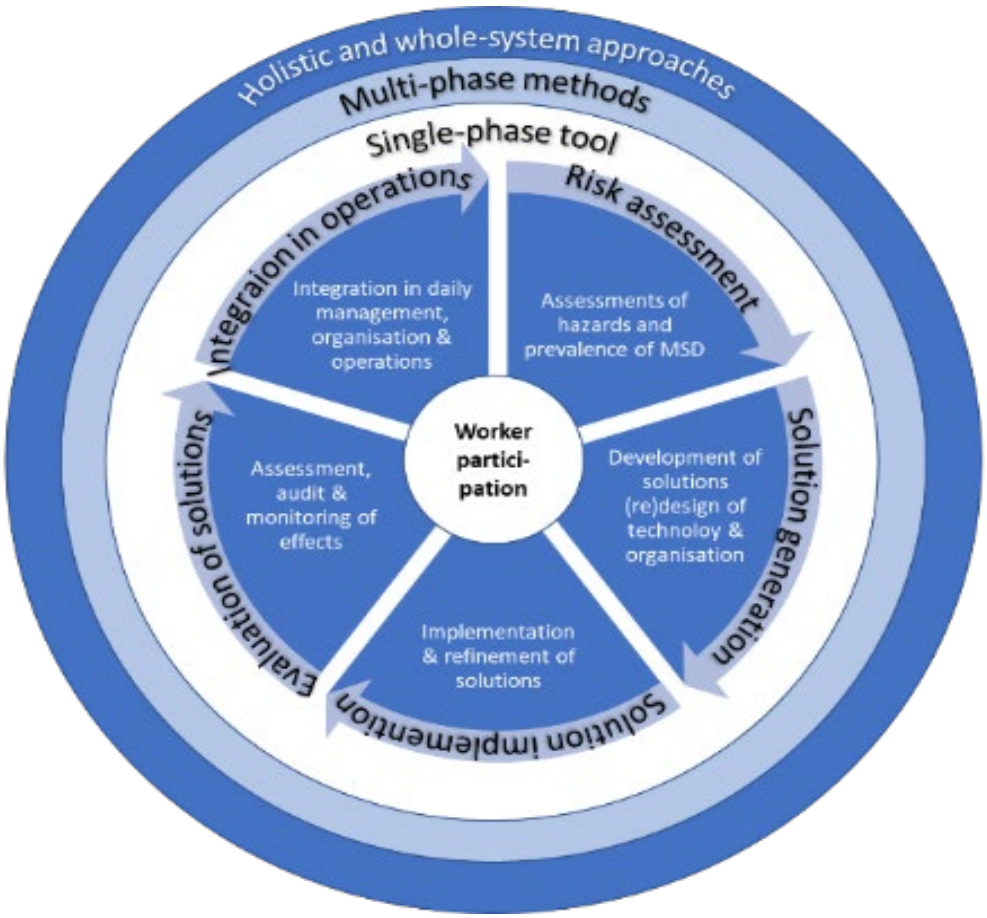


Table 1 shows the 22 methods which are included in the chapter, distributed among holistic and whole system approaches where the whole (or almost the whole process) is included, multi-phase methods, and single-phase methods.

Most methods have mainly been applied in larger or medium-sized enterprises. That is particularly the case for holistic and whole-system approaches. Some methods have been applied in smaller enterprises – but not micro – and the experience shows that it is possible with adaptations and down-scaling. In many cases, they will need the assistance of external resources such as ergonomists and OSH professionals. Some countries have systems on a sector basis which can offer such assistance, while enterprises in other countries may depend on their own resources. Multi- and single-phase methods are often easier to fit into an MSE context. It could, for instance, be in the form of organising a dialogue meeting about certain MSD risks or asking workers to suggest the redesign of a workstation. For each method, the report presents reflections on how to fit the method to an MSE context.

Table 1 Overview of methods included in chapter 2

Holistic and whole-system approaches	Multi-phase methods	Single-phase tools
▪ The Healthy Workplace Participatory Programme ▪ ErgoPar ▪ SOBANE ▪ Participatory Macro-ergonomic Work Analysis and Design	▪ Focus groups with workers ▪ Democratic dialogue ▪ Photo safari/photo voice and work debate space ▪ Future workshop ▪ Dialogue meetings and group discussions ▪ Toolbox talks ▪ Training in risk assessment and solutions generation ▪ Goldilocks work principle ▪ 5S and kaizen	▪ Root cause analysis ▪ Body mapping, hazard mapping ▪ Observation checklists and Rapid Upper Limb Assessment (RULA) ▪ Self-confrontation with video ▪ Simulation ▪ Involving workers in workstation redesign ▪ Ambassadors and champions ▪ Engaging workers in testing solutions ▪ Participatory internal audits

2.2 Holistic and whole-system approaches

The report presents four examples of holistic and whole-system approaches that accomplish the whole process from the first risk assessment to integration in operations. It is important to note that even though the methods outline the whole process, many specific decisions remain regarding the practical tools to apply during the process. The decisions cover, for example, the specific method for risks assessment and for solution evaluation. One key consideration is how to involve workers in practice throughout the process. This involves questions such as:

- How to involve workers in risks assessment?
- How to secure the voice of workers in dialogue processes?
- How to involve workers in solution testing?

The multi-phase and single-phase methods presented later in this chapter will, in many cases, inspire answers such questions.

2.2.1 The Healthy Workplace Participatory Programme

- **Aim and approach of the method**

The Healthy Workplace Participatory Programme (HWPP) was developed by the Centre for the Promotion of Health in the New England Workplace, USA. This holistic approach aims to engage workers in designing integrated solutions that can address a wide range of occupational safety and health issues and is well-suited for worker participation in MSD prevention. It was developed for teams of front-line workers and has subsequently been adapted for worker-management teams. HWPP relates to the Total Worker Health® concept, which is defined as 'policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness-prevention efforts to advance worker well-being' (NIOSH, 2021, listed below in 'Description of methods').

- **How to apply the method**

Procedures

The HWPP consists of several steps:

- If relevant, the application of the programme can be strengthened by an assessment of the organisation's readiness for change, the availability of resources and commitment from management. The assessment can be carried out by management or other organisational stakeholders involved in preparation of the programme.

- The senior managers who make key decisions for the workplace are designated as the steering committee. This group oversees the programme, authorises the design team members to meet during work time, and selects interventions for implementation. The steering committee is asked to provide time to the design team during programme start-up, and then monthly or quarterly during the intervention design process.
- One steering committee member is recruited to serve as programme champion. The champion coordinates with the facilitator(s) (see below) to help ensure the programme is making progress and enable communication and collaboration between the steering committee and the design team.
- Line-level workers are recruited to the design team by the champion or other members of the steering committee. The goal should be to represent as many units or job groups as possible, within reason. In the worker-manager version, those two groups should be balanced in number and there should be no direct-report pairs (supervisor-supervisee). The design team elects one or two facilitators to chair the meetings according to the HWPP protocol.
- In a series of meetings, the design team members prioritise workplace safety and health issues, consider underlying root causes, and devise solutions appropriate to their workplace.
- The design team presents a business case to the steering committee for their packages of selected solutions; the steering committee determines what to implement and allocates resources. In the last step, the programme is evaluated and recommendations for improvements are developed.

Resources

Sufficient time and financial resources must be allocated to prepare the organisation, design team, facilitator, and steering committee, as well as the meeting space and release time for workers to attend design team meetings and gather information outside meetings. An in-house or externally trained facilitator is required; if in-house, this person needs time to prepare for each meeting using the materials available online. As with any workplace programme to address safety and health, management input and support are needed. If design team members (including the facilitator) have little prior OSH knowledge, they may request technical support or consultation with internal or external sources through the steering committee.

Facilitating factors

The HWPP Toolkit is available online free of charge to guide organisations in implementing the programme. It includes numerous tools and recommendations for step-by-step activities: assembling the participants, identifying and selecting problems to work on, conducting root-cause analysis, developing and implementing solutions, and evaluating the programme. The HWPP Toolkit aims to support workplaces in carrying out the programme without an outside facilitator, if desired.

For the participatory programme to be successful, steering committee members must be trained and oriented to the Intervention Design and Analysis Scorecard (IDEAS) process (see Robertson, et al., 2015). The facilitator must demonstrate good communication skills and be able to facilitate group discussion and to work with different people from all levels of the organisation. The members of the design team must be interested in OSH and committed to obtaining and representing the viewpoints of their co-workers on the topics discussed.

The two-committee structure, with a steering committee and a design team, provides frontline workers with the opportunity to be involved in the analysis within a safe space to openly discuss possible work-related problems and root causes to safety and health concerns. This enables them to develop solutions that are more likely to be effective and sustainable, as well as easily understood and accepted by workers. By having two committees, frontline workers also have an effective and direct way to communicate and collaborate with organisational leaders to address health and safety concerns.

Level/type of participation

The programme primarily uses indirect participation through worker representatives in the design team. The level of participation is co-creation and shared contribution. Direct participation of concerned workers can be organised.

Information about where it has been used

The programme has been successfully implemented in corrections, office, real estate maintenance, retail and healthcare facilities in the USA.

Usefulness

The HWPP can be used in all sectors and industries to help employers and organisations adopt a participatory and systematic approach that motivates and engages workers in designing and developing solutions. The programme can also improve organisational culture, communication, teamwork and collaboration in the field of safety and health. It also establishes a sustainable process for continuous improvement and develops a business case for implemented interventions. The programme structure is highly adaptable while retaining the core IDEAS tools and its essential logic.

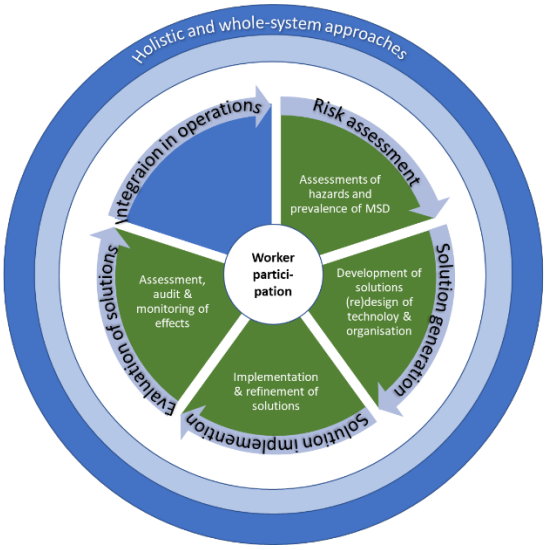
Strengths and weaknesses

The HWPP is a comprehensive and holistic participatory approach that enables employers to engage and improve worker participation and involvement in different phases from risk assessment to generation, implementation and evaluation of solutions. The programme can be applied to any safety and health issue in the work environment, including MSD prevention. The programme may require significant financial resources – depending on the extent of the problems addressed – and time for training of personnel, adoption and implementation of the programme. All members of the design team and steering committee as well as the facilitator need to be trained. Outside the meetings, it is mainly facilitators who require time for the process. In addition, expectations need to be clarified and responsibilities and roles divided accordingly. Special attention to a careful detailed planning process is important. In addition, there is little guidance on how to comprehensively evaluate both implementation and efficacy of programmes. Finally, strong management commitment and support are needed.

Relevance to or how to adapt it for MSEs

The programme is extensive and needs to be scaled down to adapt to MSEs, but it has been applied in small enterprises, and a free tool/programme is available with meticulous description of each step. The tool provides clear guidelines, recommendations and relevant training materials. The approach involves the cost of design team meetings during work time, as well as the time for the facilitator.

Method focus



- **References/URLs for more information about the method**

Case: The Healthy Workplace Participatory Programme has been used in case 36 (chapter 3).

Descriptions of method

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2.2.2 ErgoPar: A stepwise participatory method to improve ergonomics

- **Aim and approach of the method**

ErgoPar (ergonomía participativa) is a three-step participatory approach that seeks to improve working conditions based on ergonomic principles. ErgoPar is designed to:

- Identify MSD-related hazards and exposures and determine causes.
- Develop preventive measures that either eliminate or at least reduce risk situations.
- Implement and monitor the implemented changes to ensure continuous improvement.

Workers participate in every phase of the approach.

- **How to apply the method**

Procedure

The approach is facilitated by an ErgoPar methods specialist. This may be an external consultant or in-house staff member with in-depth knowledge of the ErgoPar method. Training in the ErgoPar method is offered by external organisations.

Preliminary phase: Start with a formal meeting that includes all relevant potential stakeholders, such as selected management personnel and the safety and health committee, to present the aim of the method and create commitment. If relevant, specify the workplace where the intervention takes place. Then create an Ergo Team comprising an equal number of management representatives with decision power and worker representatives with basic or in-depth knowledge of the workplace and relevant tasks. Also consider involving OSH professionals. The Ergo Team is responsible for coordinating and communicating all relevant activities and creating acceptance and commitment in the workplace. Also, the Ergo Team should receive training from the ErgoPar methods specialist, as needed, on ergonomics and working conditions in the intervention scope.

Intervention phase: It is necessary to identify causes of exposure and potential MSD hazards by using participative risk assessments, such as individual questionnaires or checklists that can be adapted to the individual workplace. Other investigative measures may include observation of workers and in-depth interviews of specific workers. Risk-assessment tools are available in Spanish on the ErgoPar website.

Based on the findings of these assessments, the Ergo Team and the health and safety committee must define, plan and implement preventive measures that either eliminate or reduce the risks. They monitor the preventive measures, assess their efficiency and outline results in a follow-up report.

Evaluation and continuity phase: Workers' opinions are obtained as part of the evaluation of the interventions, for example, through a questionnaire. The evaluation is used to propose further steps. In a follow-up report, the Ergo Team formulates a continuity strategy to ensure a systematic and iterative process and to sustain results and further improvements.

Ideally, the Ergo Team, once established, becomes a permanent body in the organisation and part of safety and health management. This helps to embed the involvement of all and to create agreement in the decision-making process.

Resources

The resources needed for ErgoPar are: A meeting room, sufficient time for the participants of the Ergo Team to get involved in the different activities, and tools to identify MSD-related hazards and exposures. The workplace should consider hiring an external consultant to train the Ergo Team in ergonomics and working conditions.

Facilitating factors

Support from the top management is crucial for commitment and for allocation of resources pertinent to the intervention. Workers of the selected workplace must participate in every phase of the approach.

Level/type of participation

Both direct participation and indirect participation through representatives are possible. The level of participation is co-creation and shared contribution.

Information about where it has been used

ErgoPar was developed in Spain as a result of research, development and validation processes. The approach has been used in several sectors, including healthcare, human health activities, and manufacturing. Links to project are listed below.

Usefulness

The method can be used in all sectors and organisational sizes.

Strengths and weaknesses

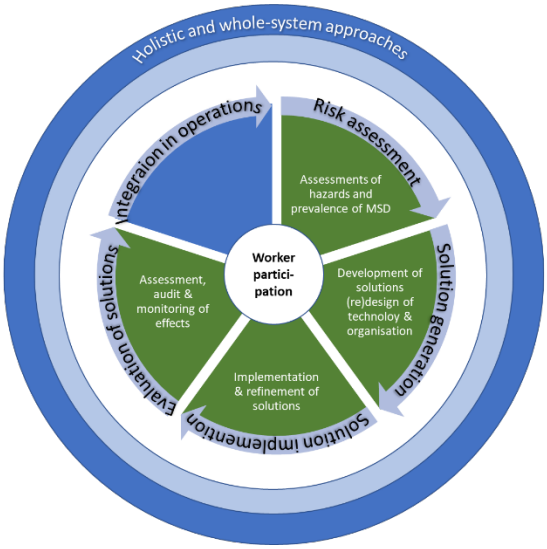
ErgoPar offers a comprehensive approach to identifying MSD-related risks and hazards, developing, implementing, and monitoring adequate measures, and ensures continuous improvement if ErgoPar and the Ergo Team become a permanent part of an organisation's OSH practices.

ErgoPar is a comprehensive method that requires a strong commitment from the workplace to ensure successful implementation. The preparation and capacity building of the Ergo Team is an important prerequisite of a successful ErgoPar intervention and requires personnel with in-depth knowledge of ergonomics and interventions.

Relevance to or how to adapt it for MSEs

ErgoPar is a comprehensive method that may be a constraint for many MSEs, though adaptations for MSEs have been done.

Method focus



- **References/URLs for more information about the method**

Cases: ErgoPar has been used in cases 7, 12 and 27 (chapter 3).

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2.2.3 The SOBANE occupational risk management strategy

- **Aim and approach of the method**

The SOBANE occupational risk management strategy is a global and participatory approach that seeks to establish an effective and sustainable prevention policy.

It has four levels of intervention: Screening, Observation, Analysis and Expertise (SOBANE).

- **How to apply the method**

A prevention consultant facilitates the process from the beginning. One or more working groups are set up, composed of workers and first-line managers, with a coordinator familiar with the work situation in each working group.

Procedures

Screening level: The working group meetings use the Déparis guideline (see link below) for participatory risk assessment. The guide is adapted according to the specific sectors and the work situation is explored in several dimensions. The most important are 1) premises and work areas, 2) work organisation and 3) work-related injuries.

Quick solutions are implemented at this level when possible. When necessary, the process for the next level is planned and problems are distributed to be solved in the working group and for further in-depth analysis.

Observation level: This level is carried out during a participatory meeting with the working group focusing on a specific, selected problem. If several problems exist, more meetings are organised.

An observation guide with 18 dimensions of work is available to help conduct the meetings (seated workstations, repetitiveness, work organisation, and so on). A synthesis of technical or organisational solutions is drafted for each selected problem with proposals for who does what, when, how and with what follow-up over time.

Analysis level: This level concerns problems that are more difficult to assess and solve. They are studied in-depth with the assistance of an ergonomics specialist, who helps analyse the work situation through systematic observation and carrying out measures if needed. Furthermore, the ergonomics specialist can help develop the ideas for solutions identified by working groups at the first two levels.

Expertise level: This level concerns very particular and specialised aspects that need to be investigated in collaboration with specialists: organisation of workstations, production process, schedule organisation, specific tools or materials, training techniques, and so on.

Resources

Meeting rooms and time off normal work tasks for the participating workers are required. Usually, meetings during the screening and observation levels last two hours. The coordinator can be any worker with OSH skills, who knows the work situation. If new to the method, time to study the method is needed for the coordinator.

Facilitating factors

The management needs to allocate sufficient resources for completion and implementation of the generated solutions during the different levels.

Level/type of participation

High level of participation through direct participation of workers during all levels of the method.

Information about where it has been used

The SOBANE method was developed in Belgium to help implement dynamic and effective risk management. It has been implemented for about twenty years in Belgian companies. The SOBANE research project was financed by the European Union, European Social Fund, and the Federal Public Service Employment, Labour and Social Dialogue in Belgium.

Usefulness

The method can be used in all sectors and sizes of organisations. The method allows implementation of an efficient and sustainable prevention policy within a company through participation of workers. The many tools in the methods give all workers the opportunity to become actors of prevention in their company.

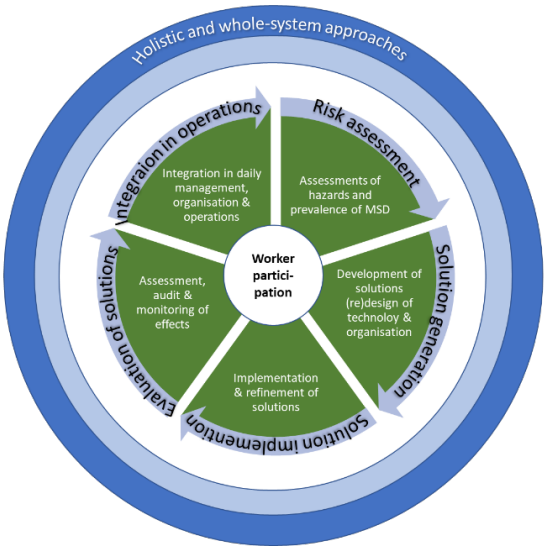
Strengths and weaknesses

There is extensive documentation of tools and procedures on applying the method, which is fitted to sectors and risk areas available (see links below). The method is simple to implement at the first two levels. The Analysis and Expertise levels require the assistance of specialists (OSH professionals) who collaborate with the workplace. They bring their technical and scientific knowledge and field experience to complement workers' knowledge of their work situation. The structured approach in different levels allows the easy solutions to be implemented without having to wait for the whole procedure to finish.

Relevance to or how to adapt it for MSEs

The SOBANE method is applicable to small businesses – especially the two first levels. The different guides suggest how small businesses can apply the method, including advice for which actors to involve and to what extent.

Method focus



- **References/URLs for more information about the method**

Case: SOBANE is used in case 37 (chapter 3).

Descriptions of method

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2.2.4 Participatory Macro-ergonomic Work Analysis and Design

- **Aim and approach of the method**

Macro-ergonomics is an approach to design and balance the work systems, focusing on human-system interaction to improve employee productivity and occupational safety and health. Macro-ergonomic Work Analysis is a method derived from broad approaches of participatory ergonomics involving all elements of the work system, and focuses on systematically identifying and mapping organisational safety and health problems, ergonomics and health risks as well as solutions. The use of macro-ergonomic work analysis helps to create an effective learning environment, to improve work satisfaction of workers, and to enhance organisational culture as well as to decrease MSD symptoms. The aim is to increase effectiveness of work through modification of the structures and processes of the overall work system (such as technology, personnel, and job design), while ensuring that human-machine and human-software interfaces are compatible with the work system's design.

- **How to apply the method**

Procedures

The process of applying the Macro-ergonomic Work Analysis and Design method involves analysing, designing, developing, and improving work systems.

Macro-ergonomic Work Analysis and Design (MEAD) is a sociotechnical systems approach that recognises the interaction between people (workers, teams, leaders) in the organisation and the technology in the work environment. The approach enhances the human-centred design process and involves workers, taking advantage of workers' detailed knowledge at each organisational level.

All stakeholders in the workplace are involved in the entire process through discussion meetings and interviews that are scheduled between each stage to exchange information and engage workers and managerial staff in the intervention process. Workers should be involved in all stages of the ergonomic evaluation and ergonomic intervention.

Macro-ergonomic Work Analysis and Design consists of several steps (Purnomo et al, 2017):

- Before starting the programme, the organisation assesses its readiness for change and available resources as well as gathers management support.
- *Define and map the sub-organisational system:* This consists of work processes with input of resources (humans, machines, raw material) and the output (both expected and unexpected outputs, such as those of risks). Furthermore, this step covers identification of the major stakeholders in the organisation (workers, managers and others) and their wishes for improvement of the work environment.
- *Appraisal for problem identification:* Evaluate and define the types of work systems, workforce and establish key performance indicators to be achieved. First, identify and analyse the work units already in the organisation, then map the existing work processes of these units and the workforce to identify and measure improvement potentials and related problems.
- *Diagnosis of problems:* Analyse causes behind both potentials and problems.
- Identify the roles and responsibilities of workers and other stakeholders for the unit where the deviation happened and where improvements are needed.
- *Proposal of solutions:* Conduct perception and responsibility analysis of identified skills and knowledge needed from the responsible personnel, including tasks and what was done. If there are any gaps between roles needed and personnel perception, then the gaps can be reduced.
- *Implementation of solutions*.
- *Validation of solutions and redesign of related support systems:* For example, if there are problems in communication or feedback, then it will be necessary to redesign the communication system related to the implemented changes.
- Improve implementation with further improvement iterations, and measure performance of both OSH and productivity.

The current method helps to evaluate the major characteristics of the work as an integrated system: technology, internal and external personnel, environments and organisational design.

Resources

Sufficient time and resources must be allocated to workers and other stakeholders to plan and conduct the Macro-ergonomic Work Analysis and Design.

Facilitating factors

The management needs to allocate sufficient resources for planning, diagnosis, implementation and validation of generated solutions, as well as evaluations and compilation of a report with the detail of the intervention. An experienced facilitator is needed to guide the company throughout the process.

Level/type of participation

The most common application of the method represents medium-level participation though direct (discussion) and indirect (observation) participation.

Information about where it has been used

The Participatory Macro-Ergonomic Work Analysis and Design has been applied in several different industries, such as a study describing participatory ergonomic intervention for improving human and production outcomes of a Brazilian furniture company (see the references about the method given below). The process led to developing solutions such as fitting workstations to optimise light, temperature, noise reduction, ergonomic solutions, as well as creating variation and reducing workers' physical effort and pain/discomfort.

Usefulness

Macro-ergonomic Work Analysis and Design focuses on systematic mapping of organisational problems and solutions by involving workers in all elements of the work system, and it is highly relevant to reducing MSD and injury risks.

Strengths and weaknesses

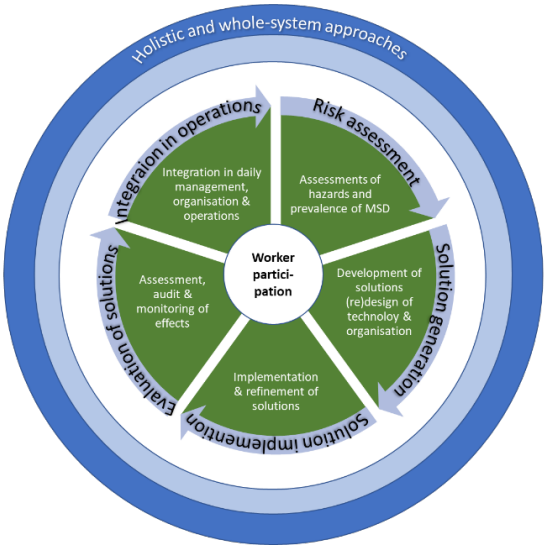
Macro-ergonomic Work Analysis and Design helps to create an understanding of the whole system to be designed, as well as individual components in the work environment. Additionally, it helps to improve work satisfaction and decrease MSD symptoms. It holds the potential to influence both workers' behaviour and efficient performance, while providing an effective learning environment and change of the organisational culture that enhances both safety and productivity. In addition, the macro-ergonomic approach generates greater performance than can be achieved through ergonomic interventions alone.

Macro-ergonomic Work Analysis and Design requires in-depth knowledge of personnel and/or external assistance involvement in the process of diagnosing problems, proposing solutions, implementing and validating solutions, which may be a constraint for many organisations.

Relevance to or how to adapt it for MSEs

The method can be used in all sectors and organisational sizes, including MSE's, since the number of workers participating is flexible. However, the extensive activities and the requirement for competent facilitators in the field of ergonomics will make it difficult to apply for many MSEs.

Method focus



- **References/URLs for more information about the method**

Cases: None for this approach.

Scientific publications

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Larson, N., Wick, H., Hallbeck, S., & Vink, P. (2015). Corporate Ergonomics Programs: Identifying Value through a Company Award Process. *IIE Transactions on Occupational Ergonomics and Human Factors*, *3*(1), 9-23. https://doi.org/10.1080/21577323.2014.1001042

Purnomo, H., Giyono, E. & Apsa, A. E. (2017). The use of macro-ergonomic work system designs to reduce musculoskeletal disorders and injury risk in training. *South African Journal of Industrial Engineering, 28* (1), 47-56. https://doi.org/10.7166/28-1-1600

Bitencourt, R. S., & de Macedo Guimarães, L. B. (2012). Macroergonomic analysis of two different work organizations in a same sector of a luminary manufacturer. *Work*, *41*(Supplement 1), 2686-2694. https://doi.org/10.3233/WOR-2012-0512-2686

de Macedo Guimarães, L. B., Anzanello, M. J., Ribeiro, J. L. D., & Saurin, T. A. (2015). Participatory ergonomics intervention for improving human and production outcomes of a Brazilian furniture company. *International Journal of Industrial Ergonomics*, *49*, 97-107. https://doi.org/10.1016/j.ergon.2015.02.002

Habibi, E., Mobinyzadeh, V., & Khademi, A. (2015). Relationship between macro-ergonomics and occupational stress in casting industry. *Journal of Basic Research in Medical Sciences, 2*(3), 24-30. Retrieved 15 July 2021, from https://jbrms.medilam.ac.ir/browse.php?a_id=167&sid=1&slc_lang=fa

Habibi, E., Zare, M., Amini, N., Pourabdian, S., & Rismanchian, M. (2012). Macroergonomic conditions and job satisfaction among employees of an industry. *International Journal of Environmental Health Engineering*, *1*(1), 34. https://doi.org/10.4103/2277-9183.100135

2.3 Multi-phase methods

Multi-phase methods include more than one component, either to cover more than one phase (but not the whole worker participation circle) or which can be applied in a similar manner in several phases. For instance, focus groups can be applied in all phases. For all the methods, it is therefore important to adapt them to the context – both of the specific company and to the phase in question.

Many of these methods can easily be applied to MSEs, though some adaptation is usually required. Again, using the focus group example, in a micro enterprise it may be possible to make a focus group

including all the workers and to focus the dialogue on a particular topic without it turning into a normal staff talk.

2.3.1 Focus groups with workers

- **Aim and approach of the method**

In a worker focus group, a small group of workers take part in a guided discussion on a particular topic. The aim of a worker focus group is to support equal sharing of knowledge, experiences, and perceptions among the participants through a facilitated group discussion. This information is drawn out in a way that would not be possible, for example, through a survey. Focus groups can be applied with various objectives, ranging from risk assessments to evaluation of solutions or any situation where participation and creative thinking among workers (and management) is needed.

- **How to apply the method**

Procedures

A focus group consists of a facilitated discussion meeting with a group of participants. Depending on the aim of the focus group, the participants can be with similar or divergent characteristics in terms of job tasks, personal characteristics (demographics), and decisional power within the organisation.

General recommendations suggest limiting the size of focus groups to five to eight participants and to avoid groups of participants with strong differences in power and status, such as workers and managers, or physicians and nurse assistants. During the focus group, the discussion may be driven by structured questions or workplace scenarios, with the flexibility to accept any relevant topic arising from the discussions.

The focus group is facilitated by a moderator with special skills or training in facilitating discussions. The role of the moderator is primarily to maintain focus on the specific topics, for example by prompting with relevant questions, and to ensure that all participants' perspectives are brought out as equally as possible. The facilitator must also ensure that discussions are carried out respectfully, that workers feel comfortable to express their views, that everything shared will remain confidential, and that everyone gets a fair opportunity to take part in the discussion. Often a set of guidelines for how discussion should take place are agreed to by all participants at the start of the discussion.

Resources

A focus group moderator, meeting rooms, and time off normal work tasks for the participating workers are required. The moderator can be any worker with special interest in planning the focus group. If new to the method, time to study details about how to do it effectively is needed for the moderator. Depending on scope of the topics for the focus group, it typically lasts between one and two hours.

Facilitation factors

Sufficient time needs to be allocated for the moderator to plan and complete the focus group discussions. Furthermore, the goal of organising focus groups is obviously to strengthen MSD prevention, and it is therefore important to plan for the expected follow-up.

Level/type of participation

There is a high level of participation through direct participation of workers and co-creation of solutions.

Information about where it has been used

The focus group method is frequently used within participatory ergonomics. An Italian research group has developed an approach that combines the focus group method with fault tree analysis in a study on musculoskeletal prevention among workers (Mosconi et al., 2019).

The British case published by EU-OSHA, 'Simple improvements to making loading easier', which is described in the short cases section, also applies focus group methodology (case 39).

Usefulness

The method can be used in all sectors and sizes of organisations. It is especially useful as focus groups can further workers' commitment for idea generation and implementation. The worker focus group allows the deep development of solutions that can be applied in practice, as well as the investigation of the causes of resistance to specify solutions, thereby opening possibilities to cope with the resistance.

Strengths and weaknesses

The focus group format holds the potential to actively engage all workers in true co-creation. The moderator should facilitate the discussion by engaging all workers and limit domination of the discussion by strong vocal participants.

It takes effort to plan a successful focus group discussion, and actions must be taken to ensure implementation of the proposed action plan (see Annex 5 Action plan template).

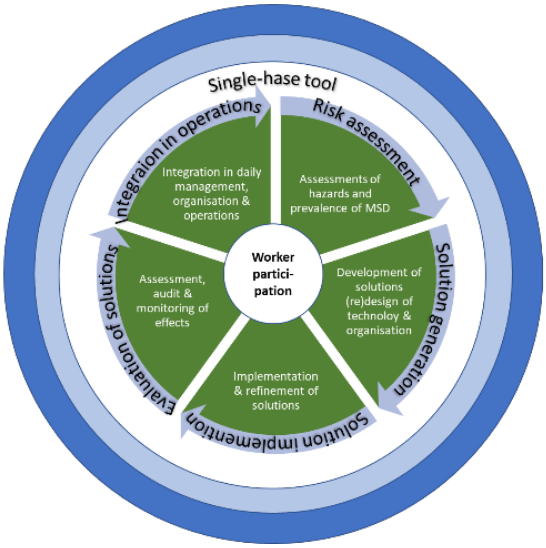
If the management has a strong agenda towards a specific solution or the workplace is conflict-ridden, this format is not suitable.

Relevance to or how to adapt it for MSEs

The focus group method is highly relevant for MSEs since the number of participants can be flexible, but moderation may require some experience or outside assistance.

Method focus

While the method is a single-phase tool, it can be used throughout all the phases of a participatory intervention.



- **References/URLs for more information about the method**

Cases: Focus groups are used in cases 18, 28, 32, 36 and 39 (chapter 3).

Descriptions of method

Participedia (n.d.). *Focus Group*. Retrieved 22 June 2021, from https://participedia.net/method/4777

EU-OHSA (2020). *Body and hazard mapping in the prevention of musculoskeletal disorders (MSDs)* Retrieved 22 June 2021, from https://osha.europa.eu/en/publications/body-and-hazard-mapping-prevention-musculoskeletal-disorders-msds/view

Scientific publications

Mosconi, S., Melloni, R., Oliva, M., & Botti, L. (2019). Participative ergonomics for the improvement of occupational health and safety in industry: A focus group-based approach. *Proceedings of the Summer School Francesco Turco*, *1*, 437-443. Retrieved 15 July 2021, from https://iris.unimore.it/handle/11380/1200913#.YO_-AD1xdaQ

Habibi, E., Zare, M., Amini, N., Pourabdian, S., & Rismanchian, M. (2012). Macroergonomic conditions and job satisfaction among employees of an industry. *International Journal of Environmental Health Engineering*, *1*(1), 34. https://doi.org/10.4103/2277-9183.100135

2.3.2 Democratic dialogue for problem-solving

- **Aim and approach of the method**

Democratic dialogue is a problem-solving process that is used to address a workplace issue and encourages diversity of thinking and opinions. The idea is that the best solutions appear in open discussions when all participants have equal rights. The aim is to involve all workers and have them contribute to the process of finding the best solution.

- **How to apply the method**

Procedures

The democratic dialogue participation method entails discussions of a topic followed by a decision-making process. The discussion time can vary; it can be useful to make the decision-making process relatively short (perhaps just ten minutes) and to encourage the participants to document their ideas and reflections for example on flip-over sheets. A useful setting can be within an existing group, such as a kaizen meeting (see section 2.3.9).

Democratic dialogues are usually conducted in homogenous groups of four to ten participants with a facilitator. All interested parties can participate, but it is acceptable to conduct the dialogue among representative workers, preferably from each level of the enterprise. The composition of the groups depends on the aim of the discussion, but the organiser of the democratic dialogues must ensure equal experience in participatory processes and power balance.

A systematic use of subgroups is important, depending on the topic. There are different ways to split up groups: 1) vertical – people from different levels of the enterprise, 2) homogeneous – people from the same position in the enterprise, 3) free choice – let people choose on the basis of personal interests, and 4) action criterion – people who need to realise what is discussed right after the session.

Democratic dialogue is based on a set of criteria which must be clear for all participants before starting the dialogue:

- The dialogue is a process of exchange between the participants and is not a one-way communication. All must be active speakers and listeners.
- All concerned by the issue should have the opportunity to participate.
- All participants help other participants to be active in the dialogue.
- All participants have the same status in the dialogue.
- Work experience is the basis for participation.
- The participants must have relevant experience about the topic.
- Everybody must develop an understanding of the topic being discussed.
- All arguments must be seen as legitimate.
- The arguments must be presented by the participant and not on paper.
- Every participant must accept if another participant has a better argument.
- The participant's role can be a subject of discussion.
- The participants must tolerate an increasing degree of disagreement as the dialogue develops.
- The dialogue must produce agreement that will generate practical action.

The dialogue enables the participants to reflect on their own experiences and to discover new and other choices. It is not important to reach agreement, but instead to broaden the participants' own understanding of things.

If an external consultant facilitates the dialogues, this person must be impartial. All relevant facts and information must be clear to all participants so that participation is based on equal circumstances.

Resources

The method is low-cost. It requires stationery materials such as flip-overs, post-its and pens to document the process and decisions, a meeting room, and time off normal work tasks for the participating workers. A facilitator is needed to manage the process.

Facilitating factors

Often, it is relevant and valuable to involve an impartial, external consultant to facilitate the democratic dialogue.

A facilitating factor is that democratic dialogue is oriented towards topics that are relevant for the participants.

Be careful not to use large plenary discussions as this can make some participants silent and often there is not sufficient time. The participants should instead be divided into smaller groups.

Level/type of participation

Work experience must be the basis for participation in a democratic dialogue where all interested workers participate. It is important to engage workers from all levels of the organisation so that the management and all the way down to the frontline worker are represented. Workers from the different levels of the organisation can be divided into different subgroups depending on the topic being discussed.

Usefulness

The method is adaptable and can be used in all sectors and sizes of organisations. Democratic dialogue is especially useful in a solution-generation phase when the generation of many ideas and perspectives is important.

Strengths and weaknesses

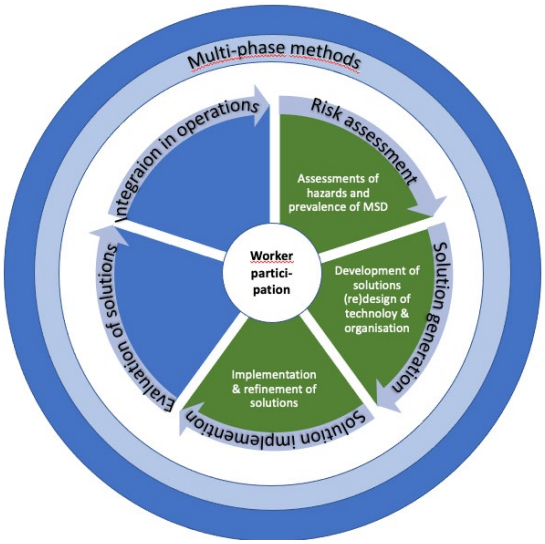
- When applied appropriately, the method ensures a strong workers' voice and commitment to workplace changes. It is relatively easy to adjust and adapt the method to fit the context and the involved participants. To facilitate the process and ensure equal participation of all stakeholders, often an experienced and impartial external consultant is involved. If participants do not have experience in taking part in a discussion or if the power balance is skewed, they may fall silent, which means that important knowledge and ideas are not shared.
- Management must be committed to follow-up by supporting implementation of dialogue outcomes; otherwise, engagement will soon diminish.

Relevance to or how to adapt it for MSEs

This method has a high relevance for MSEs. The method can be adjusted to the context, the number of participants, participants' experiences in participatory processes and decision-making, and work tasks. It does not require any specific training or skills of the participants or specialised equipment.

Method focus

The democratic dialogue method can be used in several phases and is characterised as a multi-phase method. This method can be used to involve the participants in risk assessment, solution generation and solution implementation.



- **References/URLs for more information about the method**

Cases: None for this method.

Description of method

Keith, M., Brophy, J., Kirby, P., & Rosskam, E. (2002). *Barefoot Research: A Worker's Manual for Organising On Work Security*. Geneva, Switzerland: International Labour Organisation. Retrieved 15 July 2021, from https://www.ilo.org/public/english/protection/ses/info/publ/2barefoot.htm

Scientific publications

Gustavsen, B., & Engelstad, P. H. (1986). The Design of Conferences and the Evolving Role of Democratic Dialogue in Changing Working Life. *Human Relations*, *39*(2), 101-116. https://doi.org/10.1177/001872678603900201

Ennals, R. (2019). Democratic Dialogue and Development: An Intellectual Obituary of Björn Gustavsen. *International Journal of Action Research*, *2-3/2018*, 146-163. https://doi.org/10.3224/ijar.v14i2-3.06

Kalliola, S., Heiskanen, T., & Kivimäki, R. (2019). What Works in Democratic Dialogue? *Social Sciences 2019, 8*(3), 101. https://doi.org/10.3390/SOCSCI8030101

2.3.3 Photo safari/photo voice and work debate space

- **Aim and approach of the method**

Photo safari or photo voice is an observational method based on workers' visual documentation of problems. It proceeds by asking workers to take photos of a location, a situation or process that can then be discussed by a group. The method is used for gaining an understanding of workers' needs and work hazards and to identify potential solutions to the identified hazards. It is a way of getting a fresh perspective and inspiration on how to perform work tasks differently. Usually, the method is used together with interviews to facilitate solution generation and implementation.

Similar to photo safari, work debate space uses photos to assess and discuss work hazards at weekly meetings in a cyclic, recurrent manner.

- **How to apply the method**

Procedures

The *photo safari* method is usually facilitated by an in-house or external consultant with knowledge of MSD prevention. Before it starts, workplace actors (workers, managers, OSH representatives or consultants) agree on one or more topics, such as manual handling loads, work positions, or a particular element in the work organisation. The facilitator asks small groups of workers (two to four persons) to

take photographs of situations, locations or tasks related to that topic, for example, over a two-week period, in any way they understand it. The workers photograph anything they perceive as risky or related to MSD symptoms, including examples of task performance, sequences of work organisation, workspaces, tools, unused tools or equipment, bottlenecks, paradoxes, time-consuming processes or desirable arrangements. They can also photograph work situations or equipment that they think helps to prevent MSDs. The photo safari can take place in the workers' own department, other departments or other organisations.

During the safaris, workers take notes to explain their photos and reflect on what they observe. Each worker can print their photos and glue them to a board (for example, in a lunchroom or meeting room), including an explanatory note if necessary. The photos are then discussed in a workshop, regarding the hazards shown and possible solutions. The aim is to establish a shared understanding of what the photos represent. After that, the photos should be grouped according to theme (such as positive and negative aspects of assistive devices, protective equipment, body positions, task variation and so on).

In the *work debate space* method, workers take photos of anomalies and pass them to managers for review. A facilitator selects the situations most important to discuss based on the frequency and gravity of the reported situation. Weekly group meetings are held, and the facilitator uses the photos to initiate a group debate to reflect on the decisions made during the previous meeting.

Resources

For the photo safari, time must be allocated to workers to visit their own and potentially other workstations and workplaces, and to reflect on and discuss the findings. Workers need a digital camera or a smartphone with a camera, a photo printer or electronic display system, and paper for notes. For the work debate space, time must be set aside for workers and managers to engage in weekly meetings.

Facilitating factors

- It is important to inform workers of what is expected of them to do, and not what they are expected to find.
- Work debate space is more likely to be successful if it is connected with regular workplace events like staff meetings.

Level/type of participation

Both methods involve direct participation of workers.

Information about where it has been used

- Photo safaris have been used successfully within education and community settings. They have further been refined for workplace settings and used in several sectors, such as industry, construction, healthcare and service.
- Work debate space has been used and described in detail in an electric company.

Usefulness

Both methods are simple to use for risk assessments and solution generation. The methods can initiate local processes as well as in the wider organisation. A strong advantage is that workers who do not feel confident in their verbal skills (ability to describe or analyse a problem) have equal capacity to participate.

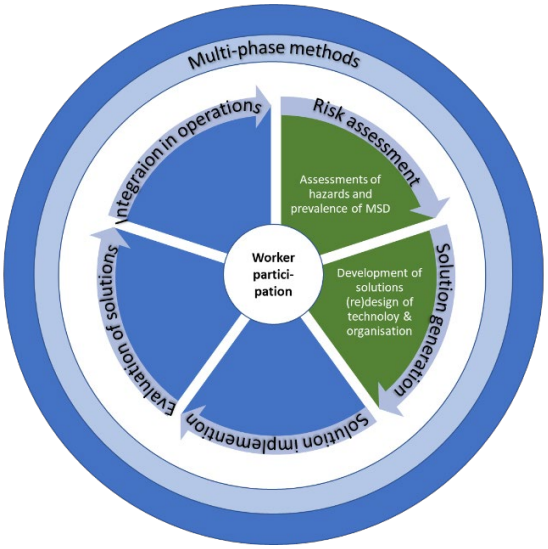
Strengths and weaknesses

Photo safari creates a common picture of a situation and, thus, a common understanding of the topics and a platform for discussions. Photos do not allow for detailed questions and answers; therefore, photo safari is often supplemented by interviews of individuals performing the jobs in question. Permission to take photos of places and people must be obtained before filming, and external host organisations must be contacted in advance. Work debate space is highly dependent on the responsiveness of the managers. One photo safari workshop works well in groups with up to ten workers. For larger numbers of workers, consideration should be given to running several workshops.

Relevance and adaptability to MSEs

This method is highly suitable for MSEs as it is easy to apply, has low cost, and does not require external consultants.

Method focus



- **References/URLs for more information about the methods**

Cases: Photo safari has been used in case 43 and work debate space in case 19 (chapter 3).

Descriptions of methods

EU-OSHA (2018). Healthy workers, thriving companies - a practical guide to wellbeing at work. Available at: https://osha.europa.eu/en/publications/healthy-workers-thriving-companies-practical-guide-wellbeing-work/view

Participedia (n.d.). *Photovoice.* Retrieved 22 June 2021, from https://participedia.net/method/5016

Scientific publications

Gaver, B., Dunne, T., & Pacenti, E. (1999). Design: Cultural probes. *Interactions*, *6*(1), 21-29. https://doi.org/10.1145/291224.291235

Docherty, P., Forslin, J., & Shani, A. B. (Eds.) (2002). Creating sustainable work systems: emerging perspectives and practice. Psychology Press. Second edition. https://www.taylorfrancis.com/books/edit/10.4324/9780203890028/creating-sustainable-work-systems-peter-docherty-mari-kira-rami-shani

2.3.4 Future workshop

- **Aim and approach of the method**

This workshop method is inspired by an action research approach and aims to co-create possibilities for change by engaging participants in a three-step, group-based workshop format.

- **How to apply the method**

Procedures

A future workshop is a type of workshop that consists of 3 phases: (1) critique, (2) utopia, and (3) realisation. The first phase relates to understanding current problems. The next phase focuses on innovative ways to eliminate current problems, and the final phase involves looking for realistic ways to implement them.

- In the *critique phase*, brainstorming techniques are used to list the specific issues and problems. This could include writing the problems on cards or stickers, which can then be clustered into

similar groups. These can then be evaluated and defined more clearly. In the case example from construction, the critique phase is conducted by introducing video recordings of the participants' own work and a description of the physical workload measured in relation to each video recording. Subsequently, the participants identified problems and decided which work situations should be modified during the intervention.

- The *utopian phase* also uses brainstorming techniques. The participants discuss selected work situations in groups. They discuss and describe how selected work processes could be carried out in the best possible way, for example, with minimal physical exertion. The ideas are discussed and written down, for example, on a flip chart. In this phase, the participants are instructed not to consider any barriers to facilitate creative resourcefulness.
- In the *realisation phase*, the participants consider possibilities and barriers to find realistic solutions for implementation and subsequently select priorities. Based on the selected priorities, the groups write action plans (see Annex 5 Action plan template).
- A *monitoring phase* can be added to check on implementation and decide if further workshops or actions are needed.

Resources

A workshop moderator, meeting rooms, and time off normal work tasks for the participating workers are required. The moderator can be any worker with special interest in planning the workshops. If new to the method, time to study details about moderating is needed for the moderator. Depending on delimitation of the topics for the workshop, it can last from two hours to a full working day.

Facilitation factors

The management needs to allocate sufficient resources for planning, completion, implementation of generated solutions, and evaluations.

Level/type of participation

There is a high level of participation through direct participation of workers and co-creation of solutions.

Information about where it has been used

The National Danish Research Centre for the Working Environment engaged 32 male construction workers in a research project and facilitated three workshops. Based on risk assessments of work hazards, the future workshops aimed to identify solutions that would decrease the number of daily work hazards events in relation to musculoskeletal pain.

Usefulness

The method can be used in all sectors and sizes of organisations. It is especially useful if workers are strongly committed and successfully involved in the idea generation. The utopian phase encourages broader and more creative thinking as the points raised in the critique phase are turned into starting points for good solutions.

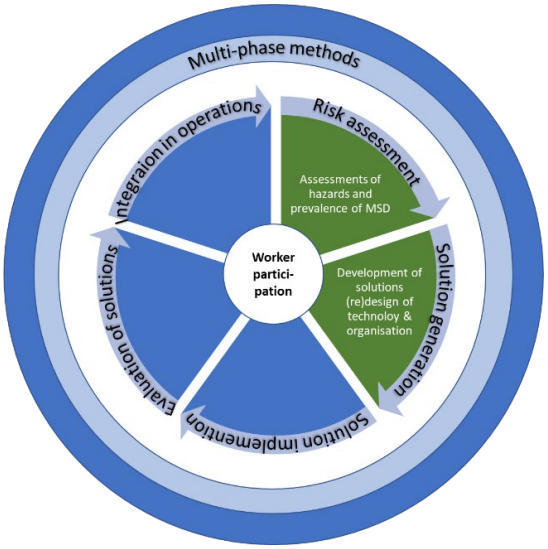
Strengths and weaknesses

- It is particularly useful when the participants have some experience in creative decision-making and works better with broader issues.
- The workshop format holds the potential to actively engage all workers in true cooperation/co-creation. The moderator should control the future workshop dialogue by engaging all workers and limit domination of the dialogue by strong vocal participants.
- It takes effort to plan a successful future workshop, and actions must be taken to ensure implementation of the proposed action plan.
- If the management has a strong agenda towards a specific solution, this format is not suitable as it requires outside-the-box thinking.

Relevance to or how to adapt it for MSEs

The future workshop is highly relevant for MSE's since the number of participating workers can be flexible, but moderation may require some experience or outside assistance.

Method focus



- **References/URLs for more information about the method**

Case: Future workshops have been used in case 42 (chapter 3).

Brandt, M., Madeleine, P., Samani, A., Ajslev, J. Z. N., Jakobsen, M. D., Sundstrup, E., & Andersen, L. L. (2018). Effects of a participatory ergonomics intervention with wearable technical measurements of physical workload in the construction industry: Cluster randomized controlled trial. *Journal of Medical Internet Research*, *20*(12). https://doi.org/10.2196/10272

Descriptions of method

Nielsen, K. A., & Nielsen, B. S. (2006). *Methodologies in Action Research: Action Research and Critical Theory* (pp. 63-87). Shaker Publishing. Retrieved 15 July 2021, from https://www.shaker.eu/en/content/catalogue/index.asp?lang=en&ID=8&ISBN=978-90-423-0289-1&search=yes

Coghlan, D., & Brydon-Miller, M. (2014). Critical Utopian Action Research. In Coghlan, D., & Brydon-Miller, M. (Eds.). (pp. 230-232). *The SAGE Encyclopedia of Action Research*. Sage. https://doi.org/10.4135/9781446294406.n99

Husted, M., & Tofteng, D. M. B. (2015). *Critical utopian action research and the power of future creating workshops* [Conference presentation]. ALARA 9th Action Learning Action Research and 13th Participatory Action Research World Congress: Collaborative and sustainable learning for a fairer world: Rhetoric or reality? Retrieved 15 July 2021, from https://www.ucviden.dk/en/publications/critical-utopian-action-research-and-the-power-of-future-creating

Participedia (n.d.). *Future Workshop*. Retrieved 22 June 2021, from https://participedia.net/method/4796

Scientific publications

Egmose, J., Gleerup, J., & Nielsen, B. S. (2020). Critical Utopian Action Research: Methodological Inspiration for Democratization? *International Review of Qualitative Research*, *13*(2), 233-246. https://doi.org/10.1177/1940844720933236

Skoglind-Öhman, I., & Shahnavaz, H. (2004). Assessment of future workshop's usefulness as an ergonomics tool. *International Journal of Occupational Safety and Ergonomics*, *10*(2), 119-128. https://doi.org/10.1080/10803548.2004.11076600

2.3.5 Dialogue meetings and group discussions

- **Aim and approach of the method**

Dialogue meetings and group discussions can be used as an intervention tool. They can be planned either as a single event or on a continuous basis. The aim of the meetings and group discussions is to distribute desired information and answer any questions while involving workers in the intervention.

Meetings can be designed and organised in many ways both regarding content and form. They can be conducted for several reasons:

- Interrupt complacency (planned meetings that break the routine can 'wake up' the workers and remind them of the need to pay attention to their health);
- Evaluation (regular meetings that allow workers to discuss incidents/problems in the workplace during the certain time-period and benefit from the ideas and views of others);
- Awareness-raising (meetings give sufficient time to advise workers on new policies and guidelines and explain how those are expected to be implemented).

- **How to apply the method**

Procedures

The common procedure is as follows:

- The group leader announces the topic and gives a brief introduction. The group leader may also give first arguments to facilitate the discussion.
- The time allocated for the discussion can vary, but usually it is around 20 to 30 minutes. All participants should actively take part in the discussion, explaining their views and opinions.
- The group leader is generally responsible for concluding and summarizing the discussion.

Discussions can also use scenarios (or conversation starters) of an MSD hazard in a workplace. The group can be asked to discuss this and then the discussion can move onto discussion of the situation in their own workplace. See EU-OSHA (2019) for examples of conversations starters for MSDs.

Resources

A group leader, meeting rooms, and time off normal work tasks for the participating workers are required. A certain degree of expertise is expected from the group leader.

Facilitating factors

Meetings/discussion groups of between six and ten people are the most effective, but the numbers of employees involved depend on the size of the organisation. If the number is less than six, the discussion may lack variety of opinions. If the number is more than ten, some members might be passive. However, it may still be useful in cases with larger organisational units so that all workers get the possibility to contribute opinions, but in that case several dialogue meetings will be an advantage. The meetings work best with participants at the same level in the organisation, so worker – supervisor/management meetings should be left to another occasion.

Level/type of participation

It entails direct participation. Meetings/discussions encourage workers to discuss their experiences.

Information about where it has been used

Meetings/group discussions are widely applied in all types of sectors. The method has proven to be an effective way to involve workers and increase knowledge and engagement.

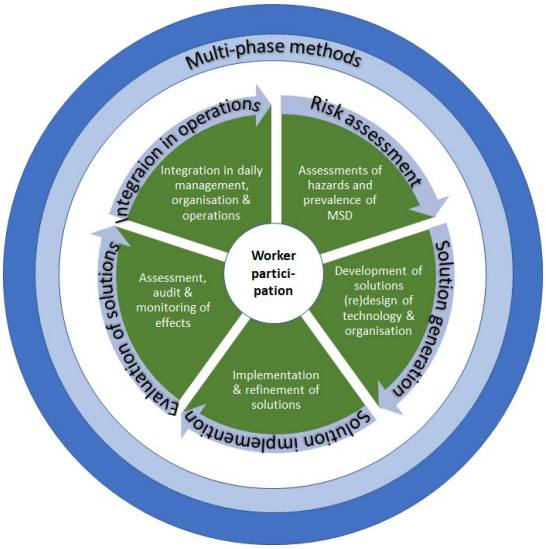
Usefulness: The method can be used in all sectors and organisational sizes.

Strengths and weaknesses: Meetings require minimal time, effort and no equipment.

Relevance to or how to adapt it for MSEs

It is highly relevant for MSEs as it is easy to use and can be conducted with a small workforce.

Method focus



- **References/URLs for more information about the methods**

Cases: Dialogue meetings and group discussion have been used in cases 5, 10, 11, 16, 22, 25, 26, 31, 44 and 48 (chapter 3).

Descriptions of methods

EU-OSHA (2019). *Conversation starters for workplace discussions about musculoskeletal disorders*. Retrieved 22 June 2021, from https://osha.europa.eu/en/publications/conversation-starters-workplace-discussions-about-musculoskeletal-disorders/view

Napo (n.d.). *Napo in the workplace*. Retrieved 22 June 2021, from https://www.napofilm.net/en/learning-with-napo/napo-in-the-workplace

Keith, M., Brophy, J., Kirby, P., & Rosskam, E. (2002). *Barefoot Research: A Worker's Manual for Organising On Work Security.* Geneva, Switzerland: International Labour Organisation. Retrieved 15 July 2021, from https://www.ilo.org/public/english/protection/ses/info/publ/2barefoot.htm

Scientific publication

Dale, A. M., Jaegers, L., Welch, L., Gardner, B. T., Buchholz, B., Weaver, N., & Evanoff, B. A. (2016). Evaluation of a participatory ergonomics intervention in small commercial construction firms. *American Journal of Industrial Medicine*, *59*(6), 465-475. https://doi.org/https://dx.doi.org/10.1002/ajim.22586

2.3.6 Toolbox talks

- **Aim and approach of the method**

A toolbox talk is an informal group discussion with a team of workers that focuses on a particular safety and health issue. It originated in the construction sector, where workers would sit on or stand around their toolboxes for a short discussion. Toolbox talks provide an effective method of communicating, spreading and reinforcing the safety message among the workforce. Toolbox talks are organised by supervisors or managers. They use the questioning approach to get the message across and listen to responses. They are a way to regularly allow workers to participate in safety matters, discuss issues and make suggestions. A toolbox talk is not a lecture or one-way presentation.

How to apply the method

Procedures

Toolbox talks focus on a single topic (anything connected with safety and health, such as back injuries and prevention, manual handling injury prevention, stretching pros and cons and so on). Ideally, toolbox talks are a part of a routine, for example, every Monday morning starts with a 10 to 15-minute toolbox talk where all workers participate. On a construction site, talks can involve workers from the different subcontractors.

An example of the steps for a toolbox talk are:

- The supervisor/manager introduces the topic, but a worker such as the OSH representative can also be the facilitator.
- The supervisor/manager outlines the importance of the topic and gives three to five primary points to discuss.
- The supervisor/manager encourages workers to join in and open discussion, where they ask questions and share their knowledge, experiences and views.
- Each toolbox talk should end with a quick summary to reinforce the main points.
- Short notes of the meeting should be recorded – often by adding writing on a flipchart or a board.

Resources

Toolbox talks require a small amount of time from the supervisor to prepare the topic of the toolbox talk. No experts or other resources are needed.

Facilitating factors

All workers in the team must participate in the toolbox talk for it to be effective. It usually takes place standing on the shop floor, and the topic should be focused on issues under the control of and directly affecting the workgroup. The supervisor should keep the atmosphere positive and encourage everyone to provide their own feedback, knowledge and experiences. It is important to use simple language for everyone to understand the key message.

Level/type of participation

It involves direct participation. Toolbox talks encourage workers to discuss their experiences.

Information about where it has been used

Toolbox talks are widely applied in construction but also in other sectors. The method has proven to be an effective tool to involve workers and increase knowledge and engagement.

Usefulness

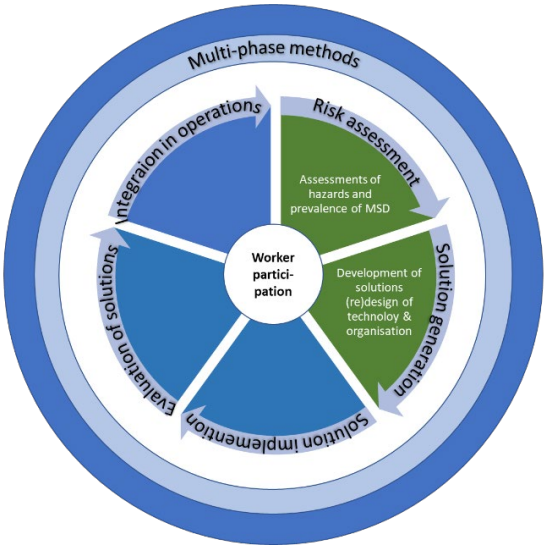
The method can be used in all sectors and organisational sizes, but is more common in the construction sector to increase the safety culture at worksites.

Strengths and weaknesses: Toolbox meetings require minimal time, effort and no equipment.

Relevance to or how to adapt it for MSEs

It is highly relevant for MSEs as it is easy to use, can be conducted with a small workforce and is simple for the manager/supervisor to apply.

Method focus



- **References/URLs for more information about the method**

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2.3.7 Training in risk assessment and solutions generation

- **Aim and approach of the method**

The aim is to use participatory training to reduce musculoskeletal exposure and risk of MSDs. Participation is ensured by involving the workers in risk assessment and in development of proposals for improvements during the training process. Participatory training is used in combination with many other methods.

How to apply the method

Procedures

Before training takes place, it needs to be considered how the training fits into the overall programme for improved MSD prevention. Furthermore, the training facilitators and the persons responsible for the programme need to specify the target group and the training objectives or outcomes. This specification is the foundation for preparation of the programme.

The training itself can last a short time (30 to 60 minutes) or be much longer, up to one day or more. If longer programmes are deemed necessary, they may be separated in time. To qualify as participatory training, traditional classroom lectures should be kept to a minimum. As much as possible, training should take place in the actual workplace and not in a classroom. The main part of the training should be based on workers' active involvement, which is secured by involving workers in active risk assessment and solution generation during the training programme.

Using champions: The participatory element can be strengthened by appointing a subgroup of experienced workers as 'champions', designated to follow up on the training sessions. They should participate in 'train the trainer' sessions to learn how to continue training their fellow workers in awareness of ergonomic principles. Due to the champions' knowledge of the workflows in the company, they are able to co-develop and tailor interventions and relevant informational material. Short sessions with champions can be more effective in involving other workers than training provided by experts.

Evaluation of the training sessions is important to ensure that the training outcome is achieved.

Resources

A training programme needs support from management and consent from workers, as well as time for participation and follow-up activities. It also needs qualified trainers and, when possible, workers trained as champions.

Facilitating factors

Management commitment and integration in workers' daily practice.

Level/type of participation

It involves a mix of direct and indirect participation.

Champions secure information flow, dialogue, and implementation of the intervention to workers. The workers thereby become more aware of risk factors for MSDs and will more likely implement changes in their workflow.

Information about where it has been used

Participatory training is a part of almost all MSD prevention programmes. It comes in many variations, and this description highlights how to strengthen the participatory element.

Usefulness

The method may be used in all types of workplaces.

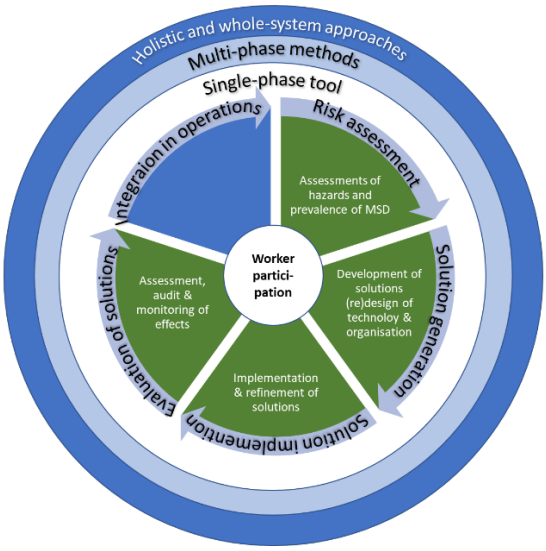
Strengths and weaknesses

- It can involve all workers, leading to more knowledge and awareness of MSD prevention.
- 'Train the trainer' sessions may facilitate permanent culture changes in the organisation towards awareness of ergonomic risk factors.
- The risk is that training becomes participatory in word only and ends up as traditional classroom training, which disengages workers.

Relevance to or how to adapt it for MSEs

External expert trainers may be costly for MSEs. However, MSEs may participate in network training organised by sector organisations.

Method focus



- **References/URLs for more information about the method**

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2.3.8 Goldilocks work principle

- **Aim and approach of the method**

The Goldilocks work principle aims to design productive work that promotes health and physical capacity of the workers. The name of this method comes from the 'Goldilocks and the Three Bears' story, where Goldilocks tries the bears' three beds and three bowls of porridge and so on, and chooses the one she finds 'just right'. It is a simple approach to finding the right balance. Applied to physical work, it concerns designing work that has the 'just right' number of different aspects of physical activity, for example, the right amount of sitting, standing and moving that is arranged in a suitable time pattern over the workday.

The creation of a 'just right' workday is based on information regarding workers' tasks and the work organisation, the workers' health status and levels of physical activity, and the potential for changing the organisation towards a 'just right' distribution. The creation and implementation of the 'just right' workday requires active involvement of all levels of the organisation (such as management, supervisors and workers) and is performed in a structured participatory process.

How to apply the method

Procedure

The Goldilocks method involves a four-step procedure facilitated by researchers or external consultants: 1) assessing the current work situation and potential for change, 2) assessing the current workers' health and physical capacity and potential for change, 3) specifying the goal, and 4) reorganising or modifying current work tasks according to the Goldilocks 'just right' principle to meet the goals.

Initially, management support is obtained and a Goldilocks group consisting of a team leader, a health and safety specialist and an OSH worker representative is formed to facilitate collaboration and consultancy.

Step 1: The consultants identify all work tasks, note the most frequently performed tasks and evaluate the potential for modifying the tasks. Through field observations, and dialogues with workers and the Goldilocks group, the consultants assess the physical actions associated with performing these main tasks. In a more extensive setup, measurements from wearable sensors of workers' physical behaviours and intensity during five working days can be added.

Step 2: The consultants asses the workers' health status (for example, smoking status, body mass index, blood pressure and fat percentage), and the workers report their perceived physical exertion during work and physical activity level during work and leisure.

Step 3: Based on data from steps 1 and 2, the consultants propose changes in the work tasks to achieve a 'just right' distribution.

Step 4: The consultants organise workshops in which participants redesign the work organisation and specify the tasks that will result in a 'just right' distribution. The workshop starts with a presentation of the Goldilocks principle and the results of the physical activity measurements. Next, workers discuss, prioritise and select tasks, and propose changes. They point at key persons responsible for facilitating the implementation and identify specific workers, management and OSH workers representatives in charge of each change.

Resources

In the two available examples of the Goldilocks principle, the process was conducted and facilitated by researchers as the extended version applied in research requires specialist knowledge regarding identification of work hazards, physical activity measurements and work organisation. Considerable resources are also needed for measurement equipment and analysis programmes. The workshops, interviews as well as the physical activity measurements and health assessment require workers' time off work. However, the principle can be used in less extensive versions.

Facilitating factors

Support from the top management is crucial for commitment to allow the changes to work organisation. Individual workers do not need to participate in all steps of the process, and the intervention does not rely on individuals' motivation as it can be implemented as a general change of work tasks. Recently, a tool has been developed to facilitate the workday planning in accordance with the Goldilocks principle and the 'just right' goal has been operationalised for direct application to workplaces. The description here builds on early research, and it is important to ensure that workers participate all the way through to avoid pushing ownership to researchers and consultants.

Level/type of participation

Both direct participation and indirect participation through worker representation are applicable. The level of participation ranges from workers providing in-depth information of work tasks to interdependence of tasks, as well as work organisation. Also, all levels from workers to top management are involved in identifying the potentials for changes towards 'just right'.

Information about where it has been used

The Goldilocks work principle has been developed by an international group of OSH researchers from Sweden, Australia and Denmark. Currently, feasibility and pilot trials are running in all three countries.

The approach has been used in kindergartens and industrial settings, and is under consideration for healthcare personnel and urban train drivers.

Usefulness

The method can be used in all sectors and organisational sizes.

Strengths and weaknesses

The 'just right' principle can be adapted to each specific enterprise and/or worker. The overall goal of promoting health and physical capacity can be tailored to a specific goal, depending on characteristics of the work tasks, worker and context, and guide the participatory development on how the productive work needs to be redesigned.

The Goldilocks principle does not address MSDs per se but general physical health, which obviously includes MSDs. The general goal of the principle is to improve health, which is a long-term endpoint, and therefore may be hard to evaluate. However, it can be operationalised through various short- and medium-term outcomes.

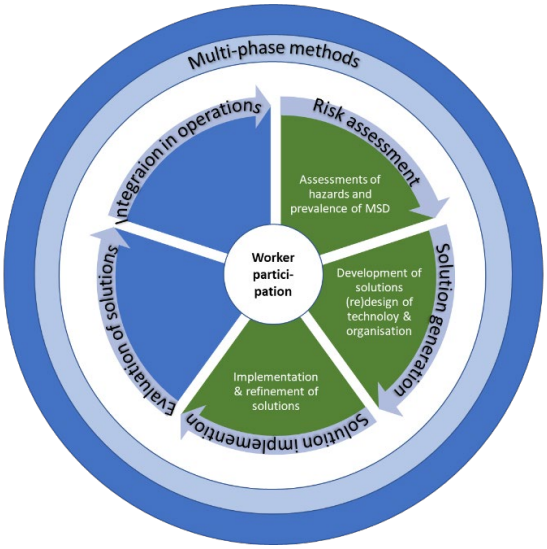
The Goldilocks principle, in its original form, is a rather comprehensive method that requires help from researchers to carry out the initial analysis and apply the findings to task changes using the Goldilocks principle. The current practical examples of implementation show that the method is feasible to implement but demands a strong commitment from the workplace and the workers.

Assisted by an OSH professional, many types of workplaces will be able to use the 'just right' principle to develop a better balance in occupational physical activities.

Relevance to or how to adapt it for MSEs

Goldilocks principle may apply well in many MSEs as it may be easier to adapt to the more varied workday in MSEs compared with larger enterprises.

Method focus



- **References/URLs for more information about the method**

Case: None for this method.

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2.3.9 5S and kaizen

- **Aim and approach of the methods**

5S and kaizen are two methods from the lean manufacturing methodology, which aims to increase the value of products or services for customers. This is often accomplished by finding and eliminating waste from production processes leading to a clean and manageable work area. The two methods can be applied for worker participation and MSD prevention, although in practice often have been applied in a top-down approach that is not beneficial for workers. They are in their basic form easy to apply in practice and can often be combined to secure sustainability of improvements. Furthermore, using the two methods integrates MSD improvements with productivity and quality, thereby strengthening the priority for both workers and management.

The term *5S* is derived from Japanese and has been translated into English as 'sort, straighten, sanitise, spread or standardise and sustain'. More recently a sixth practice has been introduced, 'safety' (6S). 5S is a methodology that provides measurable insight into the orderliness of a work area. Checklists covering an array of criteria (like cleanliness, safety, and ergonomics) are available for manufacturing and non-manufacturing areas. Implementation of 5S helps to define the first rules on how to eliminate waste and maintain an efficient, safe and clean work environment.

Kaizen is a Japanese word that translates to 'continuous improvement'. Kaizen is a management technique focusing on involvement and empowerment of all workers through a teamwork approach, interactive communications and worker participation in decision-making regarding job design. In addition, workers can make suggestions for changes through a suggestion system. Kaizen involves the entire organisation from top management to middle managers, supervisors and workers.

- **How to apply the methods**

Procedures

The two methods can be applied separately, but can have added advantages when combined. Below are descriptions of each method and their combination.

The *5S method* is typically the first step towards eliminating waste from manufacturing processes and eventually leads to improved bottom-line results. 5S includes five activities as follow: 1) SORT what is not needed; 2) STRAIGHTEN or set in order what must be kept and/or rearranged; 3) SANITISE (sweep, scrub or shine) everything that remains. That is, clean and paint the work area to provide a pleasing appearance; 4) SPREAD or standardise the routine. When others see the improvements in the selected area, give them the training and the time to improve their own work area to 5) SUSTAIN by following the procedures. Carry out regular monitoring to follow-up on the outcome.

The five activities are implemented through a combination of introductory training and regular practice with all members of the organisation. After workers are trained in the method, they analyse their work area, prepare an action plan and improve their workspaces by cleaning and reorganising them. Tools and materials are labelled and stored in organised storage locations. Shelving and racks optimise the storage of items and help to improve the order-picking process by eliminating the need to search for things. During a second one-day session, two weeks later, workers analyse and evaluate the improvements. Many organisations set up peer audits to check how the 5S principles are met as well as to ensure the plan is moving forward.

The idea behind the *kaizen method* is that the workers who perform a certain task are the most knowledgeable about that task. Consequently, by involving them and showing confidence in their capabilities, decision-making and ownership of the process, efficiency is raised to its highest level. Workshops and discussions are the main methods to encourage and involve all levels of workers in improvement and decision-making processes. Kaizen in the basic form consists of a short weekly meeting where workers and their supervisors discuss constraints for production and OSH, and suggest possible improvements related to productivity, quality and OSH. Ideas are given priority and specific persons assigned to follow up on the idea. At the next meeting, the ideas are reviewed and new ones added. Participants aim to eliminate various kinds of waste by minimising the need to search for tools, making the workers' jobs easier, reducing physically strenuous work, and freeing up space: It seeks to create a sense of involvement and belonging to the place of work for the workers.

Resources

The 5S and kaizen methodologies are easy for everyone to start using. It does not require any technical analysis or many resources. Introductory training is required for workers and supervisors.

Facilitating factors

- For both methods, managers and workers in the assigned areas must receive introductory training and participate in the application of the methods. The implementation of both methods requires management commitment and open communication in order to encourage everyone to participate with their feedback and suggestions. Both methods support the development of an open, supportive and organisational culture of continuous improvement.
- Kaizen is well-suited to follow up on application of 5S, as 5S establishes the basic good conditions and kaizen is used to sustain and add further improvements.

Level/type of participation

Both 5S and kaizen use direct worker participation in discussions as well as in change activities.

Information about where it has been used

Both methods can be implemented in all kinds of organisations and sectors, traditionally as a part of lean implementation. It has been used worldwide in a large variety of organisations. For instance, Lefrançois (2018) evaluated the implementation of lean philosophy, which generally includes the 5S and kaizen methods.

Usefulness

Both methods can be implemented in all types of companies, ranging from manufacturing plants to offices, small businesses to large multinational organisations, and in both private and public sectors.

Strengths and weaknesses

The 5S methodology is the relevant tool for an organisation to initiate improvement projects to eliminate waste, with a focus on MSD prevention. The method is simple, effective, and easily applicable. However, the implementation of 5S often requires changes in the mindset and attitudes of all members within the organisation to become sustainable, which obviously takes time. Strong support from top management is needed.

Kaizen is applicable in most types of organisations. As a team-based, problem-solving method, kaizen involves workers in implementing changes, and recognises and rewards the efforts of the workers. With

inclusion of MSDs and other OSH risks, the team approach gives workers a sense of belonging to and being of value in the organisation.

Despite the many benefits of kaizen, there are some limitations. The method may be difficult to implement in existing systems because it may infringe upon existing management strategies. Open communication and a blame-free environment within the organisation are required for kaizen to be efficient. Workers should be given the opportunity to air their views without fear.

The advantage of using 5S and kaizen to improve MSD prevention is the integration with productivity and quality, which are high on the management agenda.

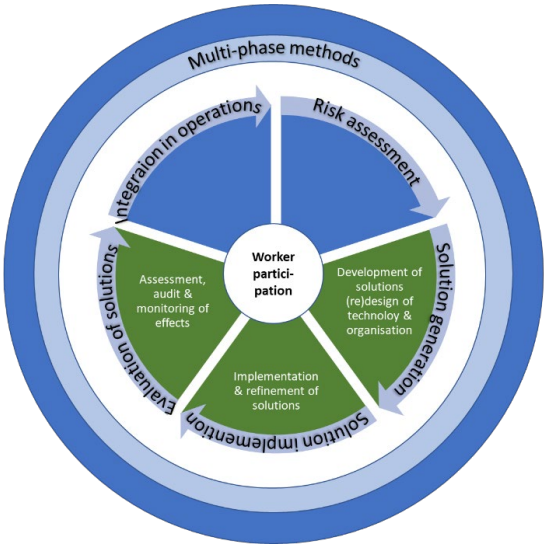
Lean tools have been subject to discussion about their effect on workers' health. The early results pointed towards detrimental effects (Landsbergis et al., 1999), whereas more recent publications (Brännmark et al., 2012; Hasle, 2014) point towards the lean tools as open systems that can be applied among others for MSD prevention.

Relevance to or how to adapt it for MSEs

Both methods can easily be adapted for MSEs in simplified versions but require commitment from management to follow up. 5S and kaizen methods are simple and do not require prior technical analysis or special equipment. Clear guidelines of how to implement each step of these methods (tools) are available. If applying the basics of the methods, training needs can be kept to a minimum.

Method focus

Both methods are multi-phase tools and focus on development of solution, implementations and evaluation.



- **References/URLs for more information about the methods**

Cases: 5S and kaizen have been used in cases 45 and 47 (chapter 3).

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2.4 Single-phase tools

As the name suggests, single-phase tools are tied to one particular phase of the participatory MSD prevention cycle, such as risk assessment or solution generation. However, some of them may be adapted for use in other phases; for example, a risk assessment tool can be reapplied during evaluation to check the risk after the work has changed. Some of the tools were developed in another context or without particular attention to participation, but this description focuses on how the method can be used for participatory MSD prevention and how workers can be involved in the application of the method.

2.4.1 Root cause analysis

- **Aim and approach of the method**

The term ‘root cause analysis’ covers a wide scope of concrete methods that can be used to identify the cause of MSD problems. There are very simple methods such as the 5 Why (originating from lean manufacturing methods) and fault tree analysis, which was originally developed for in-depth analysis of major failure risks in high-risk industries. The advantage of using this type of analysis is the possibility to identify the real root cause before deciding on a solution to implement. Root cause analysis results are easy to convey visually in graphical form, which is helpful for discussion with workers and other stakeholders about the causes of risks and the possible control measures.

- **How to apply the method**

Procedures

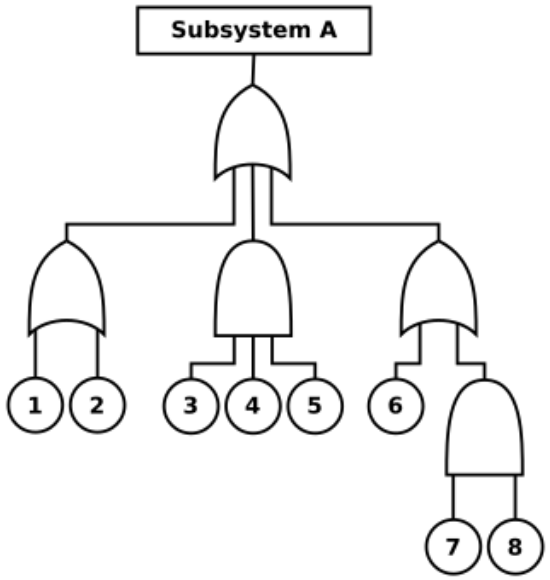
Root cause analysis builds on a logical progression from a top-level event (undesired event, risk factor or health problem), broken down into its root causes (base-level events). Root cause analysis starts with the identification and description of work activities with undesirable effects such as risk of MSDs. The next step describes the actions and situations that lead to the top-level event, and the analysis continues with identification of the next level of actions and situations leading to the already identified ones. The participants evaluate whether the final root cause is identified, or the fault tree can be further broken down. The next steps include classifying causes and analysing the resulting root structure to understand how the causes are interrelated and to think of how to prevent failures.

The end result is a visual representation of a top-level risk and the pathways of the various causal factors that contribute to the risk and the relationship between them: the results are displayed graphically in a root structure with logical combinations using a series of logic gates (such as AND and OR) (see Figure 2). This way, the top-level event is broken down into subsidiary and basic events. The basic events are

located at the bottom of the graphic as the leaves of an inverted tree. At this step, the participants are ready to start considering solutions to prevent risks and failures.

For worker participation, it is an advantage to carry out the analysis in a workshop setting where workers and other stakeholders jointly develop the root cause tree, preferably developing the tree graphically on the wall using stickers or a black/white board. This helps to systematically identify, discuss and analyse problems, the contributing factors and root causes of accidents, incidents and sicknesses, such as MSD, and develop solutions on how to prevent them.

Figure 2 A fault tree diagram



Source: Wikipedia, 2020. Available at: https://en.wikipedia.org/wiki/Fault_tree_analysis

Resources

Root cause analysis requires time for workers, other stakeholders and a facilitator to carry out a joint analysis and follow-up activities, as well as a meeting room with a black/white board or wall space for stickers. It also requires the capacity to follow up with necessary solutions to identified problems.

Facilitating factors

Anyone can in principle ask *whys* in several levels, but it is an advantage to have a facilitator with experience in structuring the process, building the cause tree and developing solutions.

Level/type of participation

It involves high-level direct participation when root cause analysis is carried out in a workshop with workers to investigate the consequences and the causes of risk factors that may cause MSDs.

Information about where it has been used

The root cause analysis method can be used in all sectors and organisational sizes. A version of the fault tree analysis was developed with a focus group-based approach and applied in a boiler industry in Italy (Mosconi, 2019) and another version in school catering in Finland (Kekkonen, 2019).

Usefulness

Root cause analysis helps to diagnose the cause of a failure and to understand how the complex system of many contributing causes can be broken down and analysed. The tool can thereby be used to determine inherent risks and to identify measures to minimise risks based on workers' participation. In particular, it helps to find the real causes of problems and thereby avoids the risk of jumping to the first and most obvious solution, which may not be very effective. It can also identify possible obstacles to

interventions under consideration, which is also very useful in avoiding wasted resources or indicating intervention elements that will be necessary for uptake to occur.

Strengths and weaknesses

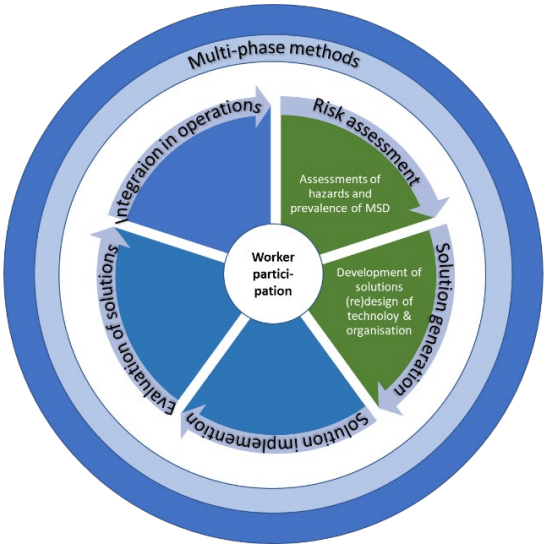
The method can be used as a part of risk assessment and in combination with other methods, such as focus group interviews or task analyses. It is very simple to use – just asking *why* questions – but the method benefits from trained facilitators.

Relevance to or how to adapt it for MSEs

The simplified version building on the lean method of 5 Whys can easily be applied in an MSE, though it can be helpful to use an experienced facilitator.

Method focus

Root cause analysis is most useful for risk assessment, but it can also be used to start the solution generation phase.



- **References/URLs for more information about the method**

Cases: Root cause analysis was used in case 47 (chapter 3) and in the detailed description of case 8 (chapter 4).

Kekkonen, P., & Reiman, A. (2019). Schools and kindergartens as shared workplaces: An analysis of the work ability management challenges of the meal and cleaning service employees. *Work, 64*(1), 161-173. https://doi.org/https://dx.doi.org/10.3233/WOR-192966

Mosconi, S., Melloni, R., Oliva, M., & Botti, L. (2019). Participative ergonomics for the improvement of occupational health and safety in industry: A focus group-based approach. *Proceedings of the Summer School Francesco Turco*, *1*, 437-443. Retrieved 15 July 2021, from https://iris.unimore.it/handle/11380/1200913#.YO_-AD1xdaQ

Descriptions of method

Leino, A., & Helfenstein, S. (2012). *Use of five whys in preventing construction incident recurrence* [Conference presentation]. 20th Annual Conference of the International Group for Lean Construction. Retrieved 15 July 2021, from https://leanconstruction.org.uk/wp-content/uploads/2018/09/Leino-and-Helfenstein-2012-Use-of-Five-Whys-in-Preventing-Construction-Incident-Recurrence.pdf

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2.4.2 Body mapping, hazard mapping

- **Aim and approach of the methods**

In *body mapping,* workers describe their health problems (mainly MSDs) by marking them on an outline of a body on paper. In *hazard mapping,* workers identify hazards at workplaces by marking them on a map of the layout of the workplace. The two methods have primarily been used for identifying MSDs and ergonomic hazards, though they can be used for identifying other hazards. They are easy-to-use methods that offer simple guidance to encourage workers to speak up about MSDs and workplace hazards.

- **How to apply the methods**

Procedures

Body mapping:

- In a collective exercise, workers use coloured pens or stickers to place dots on large (flipchart) drawings of the front and back of the body to indicate where they feel aches and pains while working.
- The result is a visual display of any clusters of workers' symptoms, which may form a basis for further discussions and solution generation.

Hazard mapping:

- Drawings of the workplace (a floor plan, or workers can draw the workplace themselves) are used by workers to indicate hazardous locations and MSD-related problems.
- At the same time, the workers add basic information (in a few words) to help clarify interpretation of the markings.
- The result is a map identifying patterns of problematic workspaces or workstations and health problems amongst workers normally doing the same or similar tasks.

The maps are then used for further discussions of the problems and solution generation. The results are used as part of risk assessment. They are not a substitute for it.

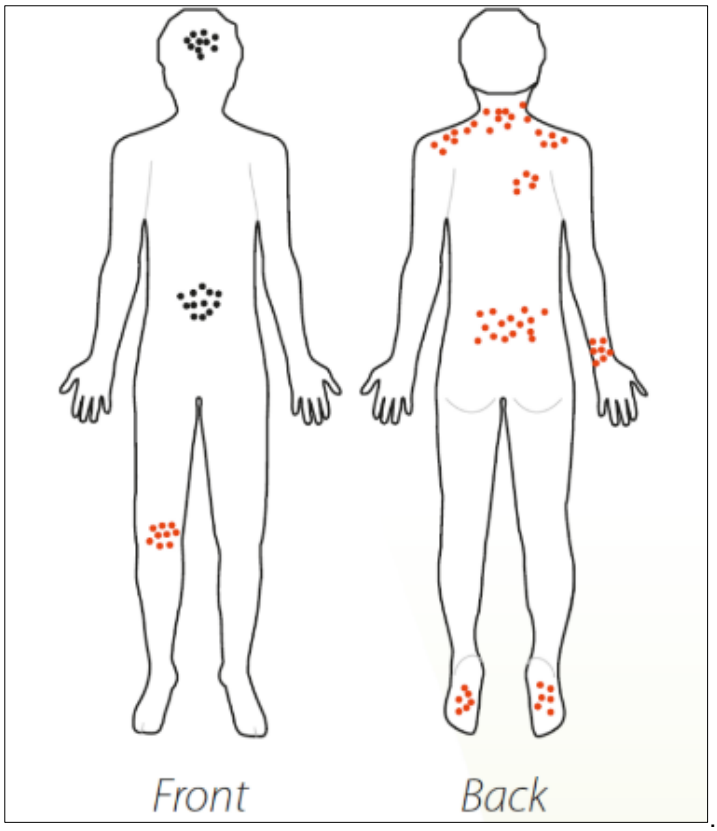
Preparation phase

An appointed facilitator organises and conducts the mapping session. The facilitator may be the employer, supervisor, worker, safety manager, or workers' representative. No MSD knowledge is needed, though it would be an advantage. The facilitator invites participants, provides flip-over sheets of paper with front and back body outlines or workplace maps, coloured markers or stickers, and tape. Different colours are used to identify different symptoms or hazards.

Group work

- *Mapping the symptoms or mapping the hazards*: In groups of six to ten persons, workers place stickers or coloured dots on the body map to show where it hurts. As clusters begin to appear, the body map may indicate whether symptoms in a particular body location is a problem for just one worker or for many. Workers mark all potential hazard areas on the hazard map that they think could be related to MSDs. They also draw the locations of workers on the map.

Figure 3 Body map with different colours



Source: European Agency for Safety and Health at Work (2020)

- *Discussing the symptoms or hazards*: Once all workers have finished marking the body/hazard map, the group looks at it and discusses the common patterns and what the clusters can mean in relation to MSDs.
- *Identifying the causes:* Once the symptoms/hazards have been identified, the group discusses the possible causes.
- *Proposing solutions and priorities for action:* Based on the discussion, workers propose solutions to minimise MSDs.
- *Evaluation of solutions*: The mapping exercise can be repeated at a later stage, for example, to see if MSD symptoms have decreased following implementation of solutions.

Resources

This is a low-cost method. The resources needed are paper/flip-overs, pens and coloured stickers, and time to conduct the analysis and group discussion. A session takes one to two hours, depending on the level of preparation, the number of participants and the type of discussion. A facilitator must be appointed to guide the process, but external consultants or experts are not required.

Facilitating factors

The anonymous use of data for later analysis/assessment should be guaranteed to maintain workers' trust in the process. It helps if the facilitator has skills in facilitating and some knowledge of OSH would also be an advantage. The method works best with a group of workers doing similar work.

Level/type of participation

Through direct participation, workers are encouraged to think about their work-related problems and describe them visually, and later participate in a group discussion.

Information about where it has been used

Body mapping and hazard mapping are actively used in MSD prevention as well as an input for risk assessment. An example is described in Thomas et al. (2018) in the waste services sector in the United Kingdom, where body mapping was used to identify levels of MSDs and help authorities better understand critical factors regarding waste collection strategies and self-reported pain. Both hazard and body mapping are presented in Keith et al. (2004), where a Canadian asbestos-exposed foundry and insulation workers graphically reconstructed their former workplaces and detailed their exposures. With body mapping, they recorded and displayed their health problems.

Usefulness

The method can be used in all sectors and organisational sizes.

Strengths and weaknesses

The strengths of body mapping and hazard mapping are as follows:

- Simple and easy to use;
- Requires minimum amount of paperwork;
- No need for an expert;
- It is based on visualisation and therefore overcomes problems of language;
- Highly participatory;
- Raises awareness and encourages discussions about health-related topics;
- Involves workers in risk assessment and monitoring of their workstations.

A very few weaknesses have been outlined, such as:

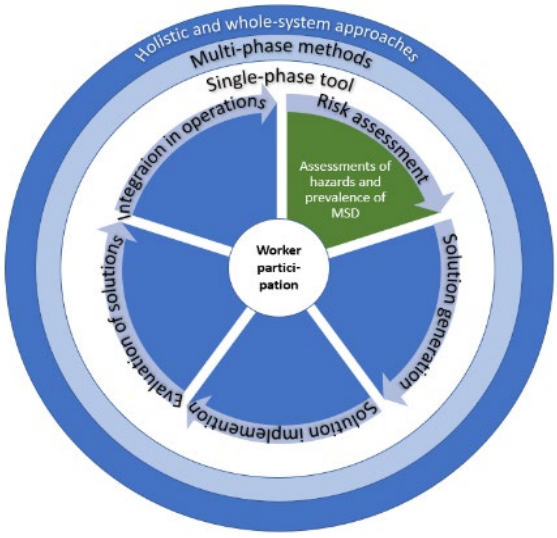
- Relatively time-consuming to get constructive outcome;
- Body mapping can be seen as too personal and may cause some workers' unwillingness to disclose their health conditions.

Relevance to or how to adapt it for MSEs

It can be applied in MSEs as it is highly participatory, easy to use and requires no training. The method can be applied either by an employer representative or a workers' representative as a discussion facilitator.

The results of mapping can be used as part of risk assessments and reviews. However, the results cannot substitute the formal risk assessments.

Method focus



- **References/URLs for more information about the methods**

Case: None for this case.

Descriptions of methods

EU-OSHA (2020). *Body and hazard mapping in the prevention of musculoskeletal disorders (MSDs)*. Available at: https://osha.europa.eu/en/publications/body-and-hazard-mapping-prevention-musculoskeletal-disorders-msds/view

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Peereboom, K. & Langen, N. (2021). OSHWiki: *Hazard mapping and MSDs.* Retrieved 30 June 2021, from https://oshwiki.eu/wiki/Hazard_mapping_and_MSDs

Scientific publication

Keith, M. M., & Brophy, J. T. (2004). Participatory mapping of occupational hazards and disease among asbestos-exposed workers from a foundry and insulation complex in Canada. *International Journal of Occupational and Environmental Health*, *10*(2), 144-153. https://doi.org/10.1179/oeh.2004.10.2.144

Thomas, D., Hare, B., Cameron, I. (2018) Using body mapping as part of the risk assessment process – a case study, *Policy and Practice in Health and Safety*, 16(2), 224-240. https://doi.org/10.1080/14773996.2018.1491146

2.4.3 Observation checklists and Rapid Upper Limb Assessment (RULA)

- **Aim and approach of the methods**

RULA (Rapid Upper Limb Assessment) and REBA (Rapid Entire Body Assessment) are easy methods for postural risk assessment in the workplace. The main idea behind RULA is to observe counts of safe or unsafe actions or unhealthy conditions in a work area over a given time. Observations can be recorded by managers using checklists with separate sections for different topics, but it is most often used by OSH professionals and with workers asked to make observations. Although checklists are not inherently participatory, they can easily be incorporated into a programme with high worker engagement. MSD-related topics include, for example, manual handling of loads with working postures and lifting techniques, use of lifting devices, and weights handled. The goal is to identify the shortcomings and use those data to apply corrections and improve safety and health.

RULA is an advanced observation method developed for use in detailed ergonomic investigations of workplaces in which work-related upper limb disorders are reported. It focuses on biomechanical and postural load requirements of job tasks/demands on the neck, trunk, and upper extremities. A coding system is used to generate an action list that indicates the level of intervention required to reduce the risks of injury due to physical loading on the operator. RULA and REBA are a bit more challenging to use than other checklists because of the coding rules, but workers could be trained in the procedure.

- **How to apply the methods**

Procedure

The RULA tool uses a systematic process to evaluate required body posture, force and repetition for the job task being evaluated. Fifteen steps using a single page worksheet is used to evaluate body posture, muscle use frequency, and forceful exertions (Hedge, 2001).

Preparation phase:

- An evaluator interviews the worker who will be evaluated to understand their job tasks. The evaluator also observes the worker's movements and postures during the work cycles. It is

important to find out the most difficult postures and work tasks, the posture sustained for the longest period of time, or the posture where the highest force loads occur.

- After interviewing and observing the worker, the evaluator can determine if only one arm should be evaluated or if an assessment is needed for both arms.

Assessment phase:

- The assessment requires that the evaluator determines postural angles of six different body positions. Using the RULA worksheet, the evaluator will assign a score for each of the following body regions:
  - upper arm, lower arm and wrist,
  - neck,
  - trunk,
  - legs.
- After the data for each region is collected and scored, tables on the form are then used to compile the risk factor variables, generating a single core that represents the level of MSD risk as outlined below (table 2):

Table 2 The RULA scores of level of MSD risk

Score*	Level of MSD risk
1-2	Acceptable posture. Negligible risk, no action required.
3-4	Low risk, but needs further investigation and changes may be needed.
5-6	Medium risk, needs further investigation and changes soon.
7	High risk, investigate and changes needed immediately.

*The minimum RULA Score = 1, and the maximum RULA Score = 7.

Based on the assessment, an action list can be developed to indicate the level and description of intervention required.

Resources

RULA and other observation checklists are relatively straightforward assessment tools and can be used with the minimum of training. These tools require no special equipment and provide a quick assessment for MSD risk, but feedback on method application and results is desirable.

Facilitating factors

Using RULA, workers must be actively involved as their description of the work procedures is crucial to decide which tasks are assessed.

Level/type of participation

There is a low level of direct participation as the method is pre-defined, and the worker's role is only to describe and show the work tasks.

Participation can be indirect (worker representatives do the observations) or direct (the worker is actively involved in the observation process and gathering information from co-workers).

Information about where it has been used

RULA is widely used in many different sectors, both by professional ergonomists and during participatory ergonomic interventions. An example is described by Morrissey et al. (2014), who presented a multi-component participatory ergonomic intervention on physical and psychosocial risk factors associated with mobile tablet computer workstations. RULA was used to assess postural risk pre and post the

redesign of the workstations. Another example described by Fonseca et al. (2016) was in a participatory ergonomic approach in the manufacture of automotive textile components in Portugal.

Usefulness

These methods can be used in all sectors and organisational sizes.

Strengths and weaknesses

RULA and other observation checklists are user-friendly assessment tools that require minimal time, effort, and equipment.

Other strengths are as follows:

- Good for educating workers on high-risk postures.
- Good for tasks which involve upper limbs.
- Graphical information for presenting to management.
- Pre- and post-intervention can be compared.

However, RULA does not propose exact recommendations on how to implement work activity changes. Therefore, RULA needs to be combined with other methods in a full participatory ergonomic process. Other limitations are as follows:

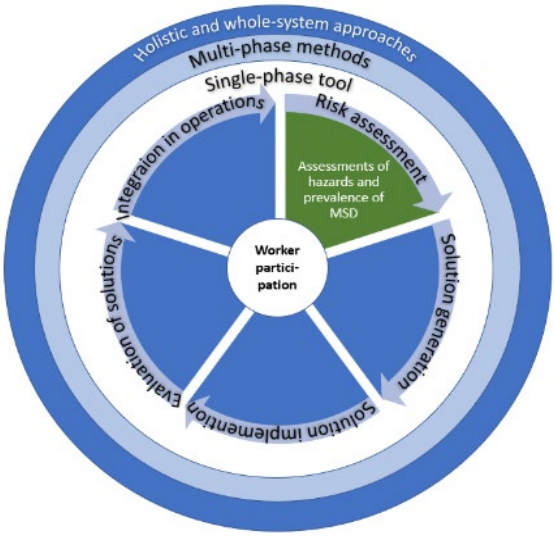
- The system for combining codes for the different elements is not intuitive for many users; practice examples with feedback is recommended.
- Does not consider the duration of the task.
- Only allows the evaluator to assess one worker's worst-case posture at one point in time.
- Does not take into account organisational and psychological factors.
- Direct observation of work tasks is needed (cannot be assessed using only photos).
- Requires separate assessment of right and left sides of the body, although in most cases it can be quickly determined which side of the body has the greater exposure to MSD risk.

Relevance to or how to adapt it for MSEs

It can be easily adapted for MSEs as it requires no special education or equipment.

Method focus

This is a single-phase method for assessment of hazards and prevalence of MSDs, but can also be used for evaluation of implemented solutions.



- **References/URLs for more information about the methods**

Case: Checklists and RULA were used in case 23 (chapter 3) and checklists in cases 29 and 38.

Fonseca, H., Santos, N., Loureiro, I., & Arezes, P. (2016). Participatory Ergonomic Approach for Workplace Improvements: A Case Study in an Industrial Plant. In: Arezes P. (Ed.) *Advances in Safety Management and Human Factors* (pp. 407-419). Springer. https://doi.org/10.1007/978-3-319-41929-9_38.

Descriptions of Methods

CUErgo (n.d.). *RULA Worksheet.* Cornell University Ergonomics Web. Retrieved 20 August 2021, from http://ergo.human.cornell.edu/ahRULA.html

Ergonomics Plus (n.d.). *A Step-by-Step Guide Rapid Upper Limb Assessment (RULA)*. Retrieved 30 June 2021, from https://ergo-plus.com/wp-content/uploads/RULA-A-Step-by-Step-Guide1.pdf

Ergonomics Plus (n.d.). *RULA Employee Assessment Worksheet* (n.d.). Retrieved 30 June 2021, from https://ergo-plus.com/wp-content/uploads/RULA.pdf

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Health and Safety Executive, UK (2016). *Full manual handling risk assessment: Examples of assessment checklists*. Retrieved 5 July 2021, from https://www.hse.gov.uk/pubns/ck5.pdf

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Osmond Ergonomics (2019). *RULA – Rapid Upper Limb Assessment. An assessment tool for assessing the risk of upper limb disorders*. Retrieved 20 August 2021, from https://www.rula.co.uk

Scientific publications

McAtamney, L., & Corlett, E. N. (1993). RULA: a survey method for the investigation of work-related upper limb disorders. *Applied Ergonomics*, *24*(2), 91-99. https://doi.org/10.1016/0003-6870(93)90080-S

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2.4.4 Self-confrontation with video

- **Aim and approach of the method**

The method involves workers from the same profession discussing a filmed situation of their own work to understand the biomechanical and psychosocial dimension of the work and identify MSD risk factors and potential solutions.

- **How to apply the method**

Procedures

Observations and creation of videos: The ergonomist or person trained in work analysis observes the work task. The workers take part in the choice of situation to be observed, and one or several workers volunteer to be observed. Observation makes it possible to identify one or several characteristic work situations to be filmed. The person observing must be experienced in the observation technique and knowledgeable about MSD causes. The observation data is analysed by the ergonomist and will be used as a basis for managing the next steps.

Self-confrontation with the volunteer worker based on the video: The worker watches the video of their filmed activity, and the ergonomist asks them to describe the reasons behind their work methods,

including the strategies and compromises used to achieve the task goals. This step allows the filmed worker to prepare for the discussion with co-workers or peers in the next step. The ergonomist can thus consolidate their work analysis.

Cross self-confrontation using the video: The filmed worker and one or several co-workers gather to watch the video. The ergonomist encourages the participants to comment on the images and discuss ways of doing the work. The ergonomist can use items from the work analysis to refresh the discussion. The ergonomist challenges the participants about the relations between OSH criteria and their work methods, asking them to explain the reasons behind their actions and compare differences.

The objective is to get the participants to understand why the worker carries out each task in a specific way and how the understanding of work methods could be relevant to MSD prevention. During the discussion, other healthier ways of doing the work are introduced to the participants. Self-confrontation involves discussion among co-workers about their respective work methods. Comparing and contrasting participants' different practices obliges them to explain the reasons behind their work methods and hence question the way work is carried out.

Resources

This method requires a person trained in work analysis and video filming to perform the general observations and run discussions among peers during self-confrontation. This person could be an internal/external ergonomist, prevention officer, OSH representative or manager. Meeting rooms and time off for workers so that they can participate are also needed.

Facilitating factors

The involvement of management in a steering committee facilitates the integration of work session prevention ideas into the work organisation. The participants are trained on issues relating to MSDs.

Level/type of participation

It involves a high level of participation through direct participation of workers.

Information about where it has been used

This method could be applied to any team of workers whose work methods could be a source of MSDs.

ANACT (French Occupational Safety and Health institution) has created a training module for OSH professionals focusing on the understanding of the biomechanical and psychosocial dimensions of work methods.

Usefulness

Self-confrontation with video can be used in all sectors and sizes of organisations. It helps workers and managers transform their views on health, activity and work constraints. Video helps workers to deconstruct their work methods and understand the real activity. Workers can participate in identification of MSD risk factors, enabling them to suggest technical and organisational solutions to protect their health and maintain their performance. Beyond the shared subjective assessment of risks, the discussions during the work sessions around the video offer a forum for learning and transmission: the participants discover other work methods through comparisons among co-workers and develop new ways of working. The method can also be used to create a training reference system.

Strengths and weaknesses

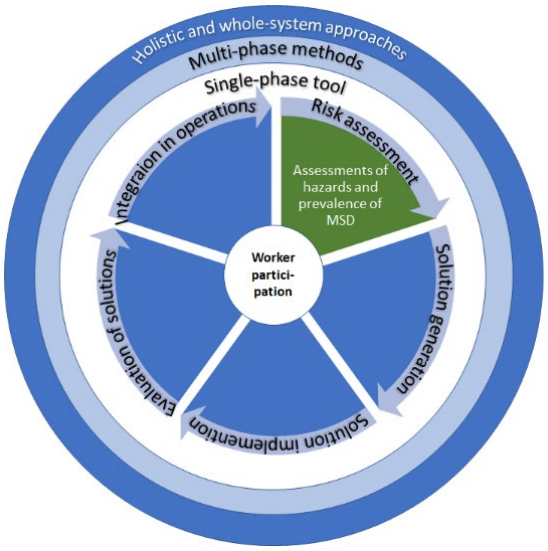
The video footage creates a forum for discussion about work.

An internal or external ergonomist runs an observation phase to choose the work situations to be filmed and discussed in the work session. The ergonomist involves the participants in the different stages of the method. The self-confrontation sessions can be run by an ergonomist but also by a first-line manager or an OSH professional officer trained in work analysis. However, it is important that there is not a large difference in seniority and therefore authority between the facilitator and the workers during the self-confrontation sessions.

Relevance to or how to adapt it for MSEs

A simple version is highly relevant for MSEs. It just requires the use of a smartphone to video the selected work task deemed to create an MSD problem, followed by discussion at the workplace about why the work is carried out in the specific way and what can be improved.

Method focus



- **References/URLs for more information about the method**

Cases: Self-confrontation using video has been used in cases 19 and 48 (chapter 3).

Poete, B. (2011). L'examen du geste professionnel en situation de formation à la prévention durable des TMS. *Troisième Congrès Francophone Sur Les Troubles Musculosquelettiques (TMS). Échanges et Pratiques Sur La Prévention*. Retrieved 15 July 2021, from https://www.taylorfrancis.com/chapters/edit/10.1201/b17456-14/interventions-dynamic-processes-joint-development-agents-organizations-johann-petit-fabien-coutarel

Kloetzer, L., Quillerou-Grivot, E., & Simonet, P. (2015). Engaging workers in WRMSD prevention: Two interdisciplinary case studies in an activity clinic. *Work*, *51*(2), 161-173 https://doi.org/10.3233/wor-141970

2.4.5 Simulation

- **Aim and approach of the method**

Simulation can be used for solution generation in the design or redesign of a workstation, workspace, production flow, and work organisation. The method is used to compare present work situations with simulated future situations when using the proposed new equipment or procedure. The comparison helps designers to avoid design errors and anticipate potential difficulties or damaging effects of MSDs in the future.

Simulation is based on knowledge co-production, worker input and reflexivity. Workers are familiar with their jobs and know how things operate daily as well the disruptions and constraints that can occur. Through simulation, workers provide input to their own future activity. They raise new questions about constraints not perceived by the planned organisation of work. Simulation encourages workers to reflect on their own present and future work tasks and develop knowledge and skills through debates with their colleagues, management and designers.

- **How to apply the method**

Procedures

Simulation is carried out in four steps:

- *Step 1:* The first step establishes reference situations of present work tasks and activities. Observations of volunteer workers who will be affected by new solutions are conducted alongside analyses of the designers' technical and organisational proposals.
- *Step 2:* Designers, technicians or suppliers prepare a model, prototype or drawing of the future situation (workstation, space, equipment).
- *Step 3:* Under the guidance of an ergonomics expert, a working group made up of the workers from the first step and relevant specialists from the company (such as an occupational physician, safety engineer, manager and so on) run the simulation session. The simulation can be conducted with computer software (for example, virtual reality or serious gaming), low-tech methods like cardboard mock-ups or 2D plans, or as simulations with prototypes or full-scale objects in cardboard. The simulation generates discussion between the participants about expected difficulties, unforeseen constraints and problems introduced as a result of the new solutions. Workers can use the simulation to try out scenarios or test reference situations stemming from the activity analysis in the first step.
- *Step 4:* Results of the simulation are used as feedback to the designer on to how modify the solution (for example, adjustment of conveyor height, location of supplies, and communication possibilities). The suggested modifications can then be re-simulated to make sure they meet the workers' needs.

Throughout the process, the group's work is presented to a project steering committee with both worker and employer representatives.

Resources

Building the simulation material can take time depending on the aim of the simulation. Simulations can be conducted with the assistance of in-house or external specialists such as technicians, production engineers and CAD/CAM experts. The suggested solutions must be well-represented and require pre-defined technical or organisational specifications. However, fewer resources are necessary for simpler solutions such as cardboard mock-ups.

Facilitating factors

A range of factors will facilitate the process, including small group size, communication with non-participants, involvement of unions and worker representatives, and managerial commitment to provide the means to create solutions. Dependent on the aim of the simulation, training of workers in simulation practice may be needed, so they not only exchange simple information but become a valuable resource or translators for the designers. The method requires a pre-design risk assessment to guide the designers in developing solutions adapted to the work tasks and needs of the workers. To assess both the pre-design situation and the solutions stemming from simulation, MSD risk factor assessment tools can be used.

Level/type of participation

It involves direct participation, but with certain simulation tools that often require expert assistance.

Information about where it has been used

This method could be used in most, sectors including industry, construction, healthcare and service.

Usefulness

When an organisation initiates a (re-)design process, the reason may be related to MSDs, but not necessarily. Regardless of the underlying reason, a transformative process will take place that presents an opportune moment for worker participation in MSD prevention.

Strengths and weaknesses

Simulation can be used as a reflexive tool that opens a forum for debate about transformations, and strengthens work relationships and workers' sense of coherence. The space for discussion is suitable for the co-development of arguments by heterogeneous workers, managers and designers. It allows workers a voice in the choice of solutions, which enables the solutions to be tailored to their work tasks

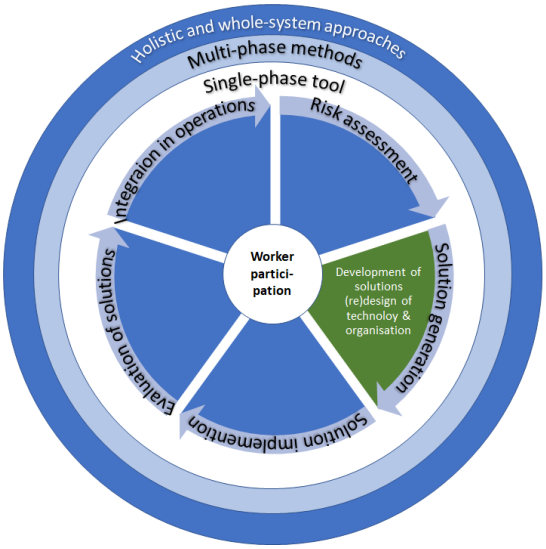
and helps to gain the workers' acceptance. The process may be facilitated by in-house or external experts in OSH or MSDs or group work facilitation.

It is important to keep in mind that the simulation is not a work situation and cannot fully represent the real-life work situation. In addition, the method is an ergonomic approach that does not aim to correct postures or existing work procedures.

Relevance to or how to adapt it for MSEs

The application of advanced digital simulation tools and CAD/CAM is difficult to approach for MSEs. However, the simpler version using cardboard mock-ups is highly suitable for small companies since it is pragmatic and enables participants and non-participants to invest in projects for (re-)design. Websites and guideline material are available (see references below).

Method focus



- **References/URLs for more information about the method**

Case: Simulation has been used in case 1 (chapter 4).

Descriptions of method

INRS (2020). *Mavimplant. Outil d'aide à la conception 3D des lieux de travail*. Retrieved 1 July 2021, from https://www.inrs.fr/media.html?refINRS=outil57

Piotet, F., & Mabile, J. (1984). *Conditions de travail, mode d'emploi ANACT*. Retrieved 30 June 2021, from https://www.anact.fr/

Scientific publications

Van Belleghem, L. (2021). *Simulating Digital Activity in the Making: Elements of Methodology.* In Bobillier Chaumon, M. E. (Ed.), Digital Transformations in the Challenge of Activity and Work: Understanding and Supporting Technological Changes, Volume 3 (pp. 211-223). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781119808343.ch16

Barcellini, F. (2019). A Developmental Framework to Analyze Productive and Constructive Dimensions of Collaborative Activity in Simulation Workshops. *Advances in Intelligent Systems and Computing*, *821*, 452-456. https://doi.org/10.1007/978-3-319-96080-7_54

Barcellini, F., Van Belleghem, L., Daniellou, F. (2014). *Design projects as opportunities for the development of activities*. In Falzon, P. Constructive ergonomics (pp. 187-203). Boca Raton: CRC Press Taylor and Francis. https://doi.org/10.1201/b17456

Daniellou, F. (2007). Simulating future work activity is not only a way of improving workstation design. *Activites*, *4*(2), 84-90. Retrieved 5 July 2021, from http://www/activites/org/v4n2/v4n2.pdf

2.4.6 Involving workers in workstation redesign

- **Aim and approach of the method**

Workstations often need to be redesigned to solve an MSD problem. To create sustainable solutions, it is crucial that workers be part of the solution generation process leading to the redesign. The following method description is based on an exemplary case where workers were involved in the creation of adjustable workstations with independently adjustable keyboards and monitors to minimise static postures and discomfort associated with MSDs.

- **How to apply the method**

Procedures

Pre-intervention: First, an intervention group is formed that includes workers from the workstation in question, health and safety representatives, first-line and middle management, and representatives from the maintenance department. An external consultant with expertise in ergonomics may also be assigned to the intervention group and provide ergonomic training.

Risk assessment: The workstation redesign starts with a risk assessment to evaluate work postures both before and after the workstation redesign. In the example mentioned, Rapid Upper Limb Assessment (RULA) (see section 2.4.3) was used for the risk assessment, and the Nordic Musculoskeletal Questionnaire was used to assess the prevalence of musculoskeletal pain and discomfort. Based on the risk assessment, the intervention group gives their opinion on:

- Difficulties encountered during work at the current workstation;
- Reported complaints related to MSDs from workstation equipment and tasks;
- Other conditions that complicate the work at the workstation.

Intervention: Next, the intervention group collaborates to generate solutions. The solution generation is structured into four steps:

- Start a brainstorming session (see Annex 5) to involve the team members in development of ideas for the redesign to eliminate the MSD-related risks;
- Organise the different ideas into solution scenarios and engage all participants in expressing their views on potential advantages and disadvantages;
- Consider cost and technical feasibility and retain the most pertinent solution;
- Develop an action plan for implementation;
- Approve and implement the action.

Post-intervention: To ensure continuous improvement, the implementation is monitored and evaluated.

Resources

The method requires a meeting room, sufficient time for the participants of the intervention group to get involved in the different activities, and tools to identify MSD-related hazards and exposures. External help might be considered to help prepare the participants for the workstation redesign. Support from top management is crucial.

Facilitating factors

The implementation group receives ergonomic training as needed on correct workstation setup for the new workstation design. A thorough problem identification is necessary to ensure that the right measures are developed.

Level/type of participation

The method involves a mix of direct and indirect participation of workers.

Information about where it has been used

Morrissey et al. (2014) evaluated workstation redesign as part of a multi-component participatory ergonomic intervention. To reduce MSDs, 46 pharmaceutical workers engaged in the redesign of mobile tablet computer workstations. The method has also been applied in several of the case studies listed in chapter 3 (see below).

Usefulness

Workstation redesign is applicable to any sectors, types of workplaces and organisations where workstations are used. Likely, redesign will have the strongest impact in workplaces where repetitive work is conducted and the prevalence of MSDs is highest.

It is common to combine workstation redesign with other interventions such as physical training and instructions on correct working postures. Also, it should be considered to supplement the workstation redesign with other methods/tools to clean and organise the workplace, such as the lean 5S manufacturing tool (see section 2.3.9).

Strengths and weaknesses

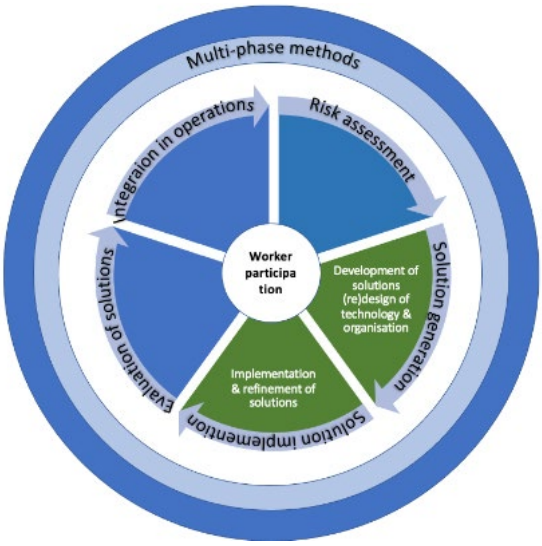
Workstation redesign is based on a thorough risk assessment to minimise potential MSD-related risks.

External help may be necessary to prepare the intervention group for the process unless in-house expertise is available. Also, workstation redesign alone is not sufficient to secure a successful intervention, but must be accompanied by other tools such as risk assessment and evaluations.

Relevance to or how to adapt it for MSEs

Workstation redesign is a comprehensive method which can be difficult for an MSE to apply directly. External assistance from professionals will often be needed. Nonetheless, redesign of a limited number of workstations can be carried out with involvement of the directly concerned workers and limited assistance from external professionals.

Method focus



- **References/URLs for more information about the method**

Cases: Worker participation in workstation redesign has been used in cases 4, 22, 23, 35 and 46 (chapter 3).

Scientific publications

Gupta, N., Wåhlin-Jacobsen, C. D., Henriksen, L. N., Abildgaard, J. S., Nielsen, K., & Holtermann, A. (2015). A participatory physical and psychosocial intervention for balancing the demands and resources among industrial workers (PIPPI): study protocol of a cluster-randomized controlled trial. *BMC Public Health*, *15*(1). https://doi.org/10.1186/s12889-015-1621-9

Morrissey, M., Baird, A., & Sims, R. (2014). Impact of a multi-component participatory ergonomic intervention on work posture, psychosocial and physical risk factors associated with mobile tablet computer workstations: A controlled study. *International Journal of occupational Health and Public Health Nursing*, *1*(3), 2053-2377. Retrieved 15 July 2021, from http://www.scienpress.com/Upload/IJOHPHN/Vol%201_3_5.pdf

2.4.7 Ambassadors and champions

- **Aim and approach of the method**

Health ambassadors are appointed or elected worker representatives who function as 'champions' or change agents within an organisation. The health ambassadors are educated and trained to engage their co-workers in health-enhancing initiatives and are given sufficient time to carry out this role. They are not the same as, or a substitute for, elected worker (safety) representatives. They are usually a champion for a specific issue. They can be appointed for a limited time, for example, to help with engaging fellow workers in preventing a specific MSD problem, or more generally, for example, as an ambassador to motivate workers and get their feedback on making office work less sedentary.

- **How to apply the method**

Procedures

Volunteer workers are trained in providing ideas and inspiration to promote health activities or solutions to health and safety issues for co-workers. The training is provided by external consultants with expertise in health-enhancing physical activity. Along with knowledge about health issues and prevention possibilities, the training covers communication and facilitation to help the ambassadors develop relations with their co-workers. The health ambassadors initiate meetings with co-workers to introduce the health ambassadors' roles, match the workers' expectations of the initiated activities, brainstorm ideas to facilitate participation in activities, and identify co-workers with knowledge or previous experience and the willingness to share their knowledge. The health ambassadors, co-workers and team managers decide on activities that best match the needs of the workers, the workspace and work tasks. When the aim is physical health-enhancing activities, they often involve the social elements of doing activities together.

Resources

Training of the health ambassadors is needed. Sufficient time must be allocated to the health ambassador to plan and conduct brainstorming sessions with co-workers, and to prepare and execute the preventive activities. Depending on the type of chosen activity, costs of equipment must be expected

Facilitating factors

Networks of health ambassadors within or across external organisations are helpful for inspiration and sharing of ideas and initiatives. Professional advice and guidance will enhance effectiveness. The health ambassadors may use 'nudging' in the form of posters placed at strategic locations. Managerial support and dedicated work time allocated to the activities will increase the number of co-workers engaging in the activities.

Level/type of participation

Worker participation is indirect through the ambassador.

Usefulness

Health ambassadors can be involved in risk assessment, solution generation, implementation and integration in daily operations, but are used predominantly in solution implementation.

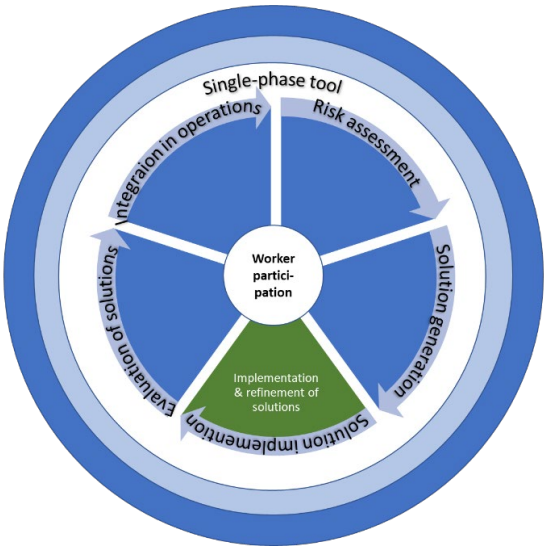
Strengths and weaknesses

It is a high-level participatory approach in which workers generate and implement solutions together with co-workers, but the health ambassadors need direct management support to establish and maintain their role.

Relevance to or how to adapt it for MSEs

Health ambassadors can be used in all sectors and sizes of organisations. The method is highly relevant for MSEs and does not require adaptation to MSE settings. In a small enterprise, one single worker might volunteer to function as an ambassador to all.

Method focus



- **References/URLs for more information about the method**

Cases: Ambassadors have been used in the cases 30 and 38 (chapter 3) and case 6 (chapter 4).

2.4.8 Engaging workers in testing solutions

- **Aim and approach of the method**

New solutions should be tested before they are fully implemented. A new solution needs to be checked to see how well it will work in practice and to ensure that it reduces MSD risk factors without creating other new or unforeseen risks. Testing involves trying out the new tool, the new machine or the new workplace as it is being set up and receiving input from the workers about the use of the solution. Performing testing enables modifications to solutions or integration of modifications more broadly into the work organisation or production process.

- **How to apply the method**

Procedures

Testing can be organised on a scale from simply trying out a new piece of equipment at the workplace and then discussing it with co-workers and supervisors to more extensive testing where the new solution is expected to be applied on a larger scale.

For the more extensive testing, workers volunteer to try out and test the technical or organisational solution. An observer critically analyses the workers' tasks when using the new solution at different time points, depending on the learning or experience required for the workers to feel comfortable with the new solution. The most basic steps to test a solution are to conduct tests involving workers with different individual characteristics (age, sex, seniority, anthropometry, training, health) and experimenting with the solution at several workstations.

To organise the assessment of the testing, checklists or evaluation sheets relating to comfort, safety, quality and performance are filled in by the workers at different points during the testing. The checklists and evaluations are then discussed during workshops or meetings with the workers. The advantages and drawbacks of the solution setup are debated, which potentially leads to requests for modifications.

Resources

Testing requires time for workers to try out the solution. For the more extensive testing, an assessment with several phases run by an internal or external expert is needed.

Facilitating factors

As many workers as possible should assess the solution and provide collective feedback during the workshops. Management's response to the needs expressed by the workers is required. During the testing phase, the expected performance and quality objectives do not have to be reached for the solution setup to be genuinely appropriated. Further, it helps to be able to make post-test modifications quickly to maintain project momentum.

The workers need to be trained before using the equipment at the new workstation.

Level/type of participation

It involves direct participation or indirect, depending on how many workers take part in testing.

Information about where it has been used

Testing is used in many small and large companies when new technology and new organisational forms are being introduced.

Usefulness

Testing is applicable in any sector or size of organisation in which new solutions in relation equipment, workstations or work organisation are to be implemented. It gives the organisation the possibility to avoid many problems related to MSDs and OSH as well as technical problems.

Strengths and weaknesses

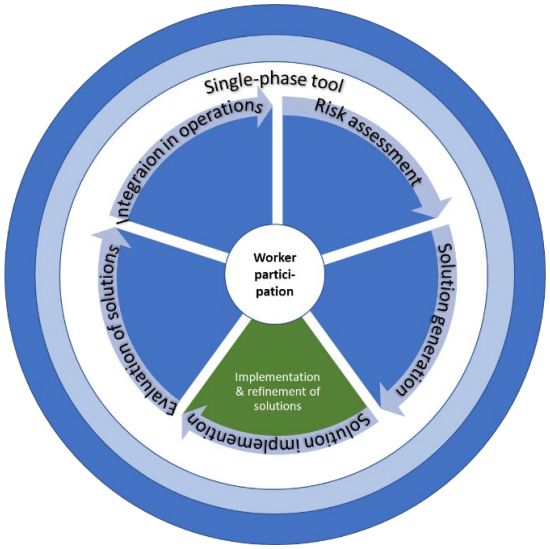
The development of individual and collective experience through testing can lead to changes in work organisation, the acquisition of new work methods and learning, and debates about worker cooperation. The collective work on the solution not only affects the initial problem, but also other problems raised by the tests, which leads to long-term prevention of MSDs. However, it can be somewhat of a dead end if management tightly controls the options that are being compared and defines the problems to be solved before any worker input is sought.

Testing must be well-structured to produce results that reduce MSDs in a participatory manner. Several phases are included (setup of working group, identification and prioritisation of problems, search for solutions with pinpointing of their advantages and drawbacks, testing of solutions, assessment of results), which can be time-consuming. However, basic testing of new solutions should always be used, even where the more extensive approach is not possible.

Relevance and adaptability to MSEs

The method is easy to implement; it is concrete and has an operational approach. Input from suppliers and prevention consultants about implementing the approach can be sought if more extensive and systematic testing is required.

Method focus



- **References/URLs for more information about the method**

Cases: Worker participation in testing of solutions has been used in cases 9, 15, 20, 22, 32 and 34 (chapter 3).

Scientific publications

Bourmaud, G. (2014). From use analysis to the design of artifacts: The development of instruments. In Falzon, P. (Ed.) *Constructive Ergonomics* (pp. 190-203) Boca Raton: CRC Press Taylor Francis. https://doi.org/10.1201/b17456-16

Petit, J., & Coutarel, F. (2014). Interventions as dynamic processes for the joint development of agents and organizations. In Falzon, P. (Ed.) *Constructive Ergonomics* (pp. 160-175). Boca Raton: CRC Press Taylor Francis. https://doi.org/10.1201/b17456-16

2.4.9 Participatory internal audits

- **Aim and approach of the method**

Audits originate from occupational health and safety management systems (including certification of, for instance, OHSAS 45001), but the principles can be applied in a wide variety of monitoring activities from formalised certification audits to walking around and talking to workers.

An audit is a monitoring activity that can be used to evaluate the implementation of risk control and solutions. It is defined as a systematic, independent and documented process for obtaining and objectively evaluating evidence to determine the extent to which criteria are fulfilled. For example, audits can be conducted to assess whether hazard identifications, risk assessments or controls are implemented and maintained.

For MSD prevention, participatory audits can be carried out by workers to systematically evaluate achievements and identify new problems to solve.

- **How to apply the method**

Procedures

For participatory internal audits, the key point is to ask and train workers to carry out audits in the workplace. Normally, it will be OSH representatives either alone or with a supervisor. The company decides the level of formalisation of the audits. If part of a certified management system, the formal requirements can be quite extensive compared to a small company where the OSH representative does internal audits.

To evaluate the implementation of solutions and the risk controls, auditors collect information, usually by combining three different methods to obtain data, increase credibility and overcome biases:

- Interviews with workers and management;
- Review of documents, procedures and plans;
- Facility walkaround/observation.

Interviews: Interviews are typically conducted with selected workers and management. A combination of individual interviews with workers and supervisors is the most frequent method. For more extensive internal audits, these can be supplemented with focus group interviews with five to eight workers. When conducting the interviews, auditors need to focus on creating an open and trusting atmosphere, which is easier when the auditors are workers themselves. For example, auditors should explain why the workers are being interviewed and stress the fact that the obtained information will be used to evaluate and possibly improve solutions related to MSDs. The auditors need to ensure confidentiality so workers can voice their concerns freely without fear of negative consequences.

Document review: Unless as part of a certified system, documents reviews are kept to a minimum.

Facility walkaround: The facility walkaround is the key element of the internal audit. It allows the auditors to understand the work environment, its surroundings and the risks workers are exposed to – both by looking and by talking with workers and supervisors. OSH reps may swap departments so that they do audits in departments other than their own. Often a simple checklist, such as the International Labour Office (ILO) Ergonomic Checkpoints, is used as a tool.

Findings: The auditors prepare a 'findings report' to be presented at a meeting with management and worker representatives. Again, the formality level depends on the internal agreement and purpose of the audit. The report can be quite extensive and formal for certified systems, or a less formal presentation at a meeting at a simpler level.

Resources

Sufficient time must be allocated to the auditors to plan and conduct the audit and to prepare and finalise the audit report. Once the audit process is completed, the company must follow up on the audit findings, preferably by developing corrective action plans (see Annex 5 Action plan template). An audit programme can include continuous cycles of follow-up audits to monitor and assess implemented actions.

The best results are achieved if the auditors receive initial training and get the opportunity to carry out several audits to gain experience.

Facilitating factors

An audit group should have knowledge and abilities in several occupational health and safety-related areas. Therefore, it is recommended that the group include worker and safety committee representatives and OSH professionals with knowledge in the following fields:

- The principles of MSD prevention;
- Identification of MSD hazards and risk assessment methodologies;
- Good practices, design of work areas and operating processes.

Level/type of participation

Worker participation is indirect through the OSH representative.

Usefulness

Audits can be used in all industries by organisations that wish to make a systematic evaluation of solutions. Although the method has its origins in the assessment of occupational health and safety management systems, it can also be applied to the assessment and monitoring of interventions that target MSD prevention – in particular when carried out by worker representatives.

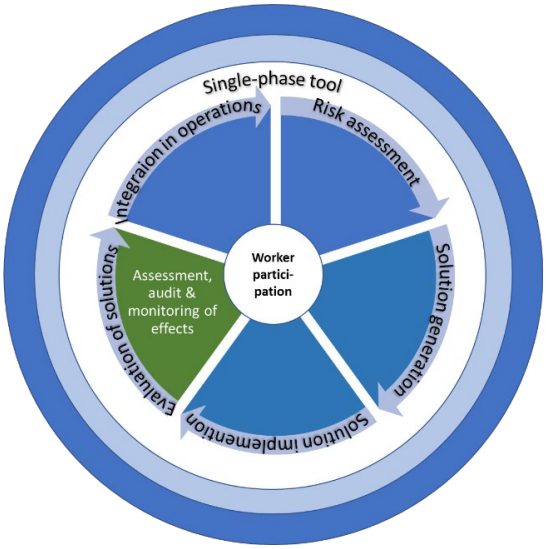
Strengths and weaknesses

Audits offer a comprehensive monitoring toolset to evaluate the implementation of solutions, though making the internal audit process too complicated could be a drawback. Most companies will benefit from simple audits carried out by worker representatives in cooperation with supervisors and OSH professionals if available in the company. Audits can also be considered as an evaluation method, depending on the other phases being implemented with other methods.

Relevance to or how to adapt it for MSEs

Audits require a broad knowledge of MSD prevention, which may limit the relevance for MSEs. External OSH consultants may facilitate the process. Use of a simple checklist by the OSH representative will be very useful for a small enterprise.

Method focus



- **References/URLs for more information about the method**

Case: None for this method.

Descriptions of method

Dobrescu, E. (2016). OSHWiki: *Auditing, reviewing and certifying occupational safety and health management systems*. Retrieved 30 June 2021, from https://oshwiki.eu/wiki/Auditing,_reviewing_and_certifying_occupational_safety_and_health_management_systems

Drury, C. G., & Dempsey, P. G. (2012). Human factors and ergonomics audits. In: Salvendy, G. (Ed.) *Handbook of human factors and ergonomics* (pp. 1092-1121). Wiley. https://doi.org/10.1002/9781118131350.ch39

Scientific publication

Jespersen, A. H., Hohnen, P., & Hasle, P. (2016). Internal audits of psychosocial risks at workplaces with certified OHS management systems. *Safety Science*, *84*, 201-209. https://doi.org/10.1016/j.ssci.2015.12.013

2.5 Choosing a method

There are many different methods that can be used. Whole-system approaches are the most comprehensive, but tend to require more resources and professional assistance for their application. In some cases, it can be easier to adapt the methods to the specific context by combining a series of single-phase or multi-phase tools and thereby making the process simpler, although this will require more planning. For example, dialogue meetings or forum groups can be the basic method for most of the worker participation across the whole process in solving a relatively simple MSD problem, such as

the introduction of basic lifting aids (a hoist or a lift). Risk assessment and solution generation can take place at dialogue meetings with the workers, where responsibility for implementation of the selected solution is delegated. A new dialogue meeting can then be used for evaluation and (later) discussion of integration into operations.

Dialogue meetings also constitute an example of a method that can easily be applied to MSEs, while many other methods need considerable adaptation and/or external professional assistance to use in MSEs. Some methods have been used in broader OSH issues and do not particularly target MSDs but can easily be focused on MSD prevention. Other methods are drawn from fields such as lean manufacturing (kaizen and 5S) or OSH management systems (audits). By involving workers in their application, they can be used for MSD prevention. These methods have the advantage of already being applied in operations and thereby are potentially easier to integrate.

3 Examples with worker participation in practice

3.1 Introduction to the examples

This chapter presents 48 examples of worker participation in MSD prevention in practice. The examples were collected from systematic search of the scientific literature and from suggestions from EU-OSHA focal points as well as the researchers' network. The examples cover the main sectors of the EU labour market and diverse groups of workers. The examples also cover a wide diversity of methods and tools, and it should therefore be possible to find examples which can serve as inspiration for introducing or improving worker participation in MSD prevention.

The descriptions of the examples are short with many headings to make it easy to scroll down the examples and find something that could be useful. Each example also includes easy-to-read bar graphs of MSE relevance and level of participation as well as the process wheel to indicate the focus.

3.2 Sector: Human healthcare and social work activities

3.2.1 Reducing demanding work tasks and obtain physical capacity

Sector: Human health and social work

Main method: Workshops

Key message:

Workshops can facilitate changes in demanding work tasks and thus reduce low back pain.

MSE relevance:

The workshops are easy to organise in an MSE, but often require an experienced or external facilitator. The workshop format can easily be formatted to the specific context.

Level of Participation:

Direct and indirect participation. All participants identified demanding work tasks. Worker representatives prioritised the identified work tasks and developed solutions and an implementation plan.

Country: Denmark

Organisation: Public nursing homes and home care services in a large municipality.

Participants:

Workers in elderly care (nursing homes and home care) in a large municipality. Participants were mainly nurses' aides who were either social and health service aides or helpers, working more than 20 hours per week and being 18-65 years of age. Kitchen and cleaning personnel as well as janitors were also invited to participate. In total, 594 workers participated.

Main health problem and hazards:

Nurses' aides suffered from low back pain caused by physical workload and frequent patient handling activities, and fear avoidance beliefs.

Main action:

Participants identified physically demanding work tasks, followed by prioritisation, solution generation and development of implementation plans in workshops.

Participation:

All 594 workers were invited to identify and make notes about physical demanding work tasks and put them in a physical mailbox. An ergonomics group (consisting of 5-7 workers and an instructor) participated in two 3-hour workshops. In the first workshop, the ergonomics group prioritised 3-4 work tasks from the mailbox. The focus was to prioritise work tasks that could be easily addressed ('low hanging fruit'). In the second workshop, the ergonomic group developed solutions to the prioritised work tasks and developed an implementation plan. In two follow-up meetings, the implemented solutions were evaluated and adjustments made. At the end of the intervention, the ergonomics group prepared for the maintenance phase to ensure sustainable solutions. It then transformed to an ergonomics and health promotion group and continued to identify risks and develop and implement solutions.

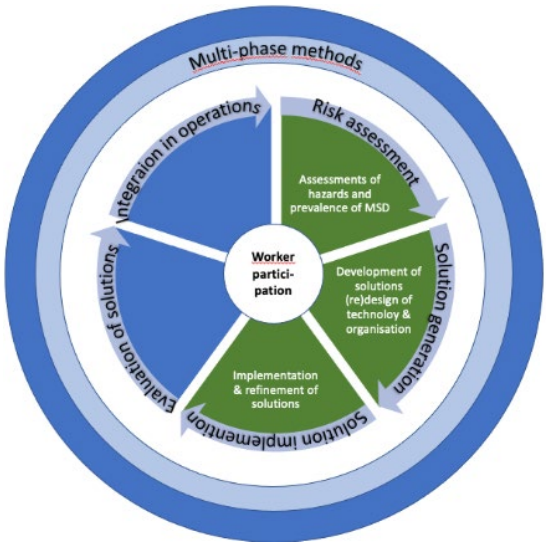
Results:

This case demonstrates that workers' representatives can use workshops to identify and prioritise demanding work tasks and develop corresponding solutions; this can be a successful element of reducing low back pain for workers in elderly care.

Method and approach:

Workshops for worker representatives are a multi-phase method. The participants are involved in risk assessment, solution generation and solution implementation.

Workshops are easy to organise and adjust to the specific content and aim. This means that they can be used for several phases, depending on the aim and content.



References:

Rasmussen, C. D. N., Holtermann, A., Mortensen, O. S., Søgaard, K., & Jørgensen, M. B. (2013). Prevention of low back pain and its consequences among nurses' aides in elderly care: A stepped-wedge multi-faceted cluster-randomized controlled trial. *BMC Public Health*, *13*(1), 1-13. https://doi.org/10.1186/1471-2458-13-1088

3.2.2 Participatory ergonomics in centres for people with disabilities

Sector: Healthcare workers / care workers

Main method: ErgoPar method (see section 2.2.2)

Key message:

This method considers workers as a fundamental source of information to achieve efficient and effective occupational risk prevention. Use of the method improves working conditions for all care workers.

MSE relevance:

Medium relevance for MSEs. The approach is facilitated by an ErgoPar methods specialist. This may be an external consultant or in-house staff member with in-depth knowledge of the ErgoPar method. Training in the ErgoPar method is offered by external organisations.

Level of Participation:

The method has a medium level of participation. Both direct participation and indirect participation through worker representatives are possible.

Country: Spain

Organisation: Four public centres for people with disabilities.

Participants: 85 care workers, predominantly female women 35-43 years of age.

Main health problem and hazards:

Care workers suffered from MSDs, especially in the lumbar spine, neck, wrists and hands and knees. The main risk factors were walking, forward bending, and person lifting and moving, pushing and pulling.

Main action:

The case used ErgoPar, a 3-step whole-system approach based on ergonomic principles of identification of MSD-related risks and exposures, and development, implementation, and monitoring of preventive measures and solutions (see method in section 2.2.2).

Participation:

In the presented case, care workers participated in solution generation, implementation, and evaluation by use of the ErgoPar method.

In the preliminary phase, an Ergo Team consisting of a manager, worker representatives and an ergonomist was established. In three 2-hour sessions, the ergonomist trained the other team members in the ErgoPar approach.

In the intervention phase, the Ergo Team conducted a risk assessment. In a series of meetings, the team analysed main causes of exposure and identified potential MSD hazards. Additionally, the team lent on information obtained through interviews and observations, as well as the experience and knowledge of the group members.

In the assessment and continuity phase, the Ergo Team formulated a continuity strategy based on the analysed results and initiated the implementation of solutions in collaboration with the Health and Safety Committee.

The care workers participated in the solution generation, implementation and evaluation.

Results:

During the participatory process, the following preventive measures were taken:

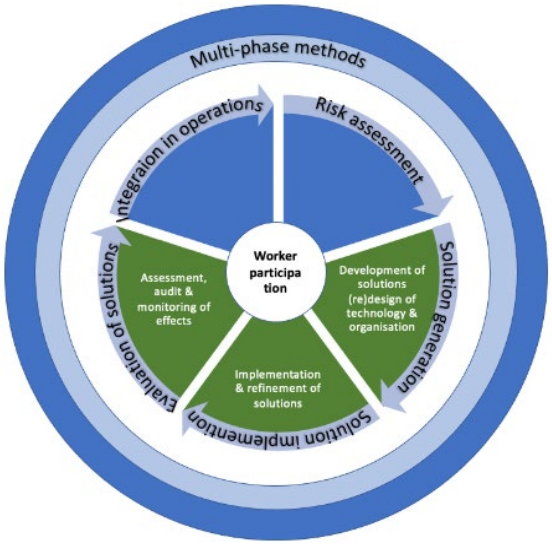
- The workplace was redesigned to allow for the introduction of mechanical assistive technologies for the care workers, such as modification to the users' bathroom and the swimming pool facilities. Further, the workspace was reorganised to optimise workflow.
- Technical and organisational measures were developed that raise the working plane and/or improve lumbar support for the care workers, including placing wheels on beds, buying height-adjustable chairs and avoiding activities on the floor.

- New procedures for the purchase of material and equipment was introduced, which included consultation of workers prior to placing an order.
- Measures aimed at improving the training of the care workers, both in terms of prevention (knowledge to identify ergonomic risk factors and their causes) and in the definition of clear work procedures that facilitate the development of the task (tasks to be carried out between two people, use of mechanical equipment, user's particularities).

The overall results were improved work conditions and work relations for all workers.

Method and approach:

Although ErgoPar is a holistic approach, the current case describes worker participation during the solution generation and solution implementation and evaluation. Direct worker participation was combined with the involvement of the workplace Health and Safety Committee.



References:

Instituto Sindical de Trabajo, Ambiente y Salud (n.d.). *Manual del Método ERGOPAR (V2.0)*. Retrieved 22 June 2021, from http://ergopar.istas.net/el-metodo-ergopar/manual-del-metodo-ergopar-(v2.0)

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3.2.3 Improved use of assistive devices in patient transfer

Sector: Human health and social work activities

Main method: Workshops (see section 2.3.1)

Key message:

Involving representative healthcare workers through workshops increases the use of assistive devices for patient transfer.

MSE relevance:

Workshops are easy to organise in an MSE but often require an experienced or external facilitator. The workshop format can easily be formatted to the specific context. In the presented case, the initial analysis was made by researchers, and they used of questionnaires, push buttons and accelerometers, which is of less relevance for MSEs.

Level of Participation:

The level of participation in this case is medium, due to indirect participation of representative healthcare workers in the workshops. However, all 625 healthcare workers from the 27 departments participated in the implementation and evaluation of the solutions.

Country: Denmark

Organisation: 27 departments from 5 Danish community hospitals participated.

Participants:

Two to five representative healthcare workers and managers from each department, and the hospital's health and safety staff, participated in the workshops. In total 625 healthcare workers participated in the implementation and evaluation of the solution generated by the participants at the workshops. The majority of participants were female (89%).

Main health problem and hazards:

Healthcare workers are at high risk of back pain and back injuries and other MSDs, which increases the risk of long-term sickness absence.

Problems are caused by physically heavy, manual patient handling tasks and risk of sudden, unexpected loads in relation to patient handling. A common problem is that patient hoists and other devices for assisting the transfer of patients are often available but not used.

Main actions:

Researchers collected information about barriers and potential solutions for using assistive devices. A questionnaire, interviews, observations as well as an analysis of a 'best practice' hospital were conducted. The participatory part of the intervention consisted of two 2-hour workshops with workers developing solutions and an action plan on how to implement the solutions, and a revision of the action plan.

Participation:

In the first workshop, the participants developed potential solutions on how to improve the use of assistive devices in their department. During the workshop, the participants developed an action plan with possible solutions. The second workshop was conducted approximately 3-4 months after the first workshop and consisted of two parts: discussion of the department's experiences with implementing the action plan developed in the first workshop, and the development of a revised action plan focusing on the five solutions, which the participants gave the highest priority for implementation during the next 6-9 months.

While creating the action plans, the participants in the workshop described why the solutions were important for their department, appointed persons responsible for the implementation of the solutions, and established deadlines for the implementation. All healthcare workers participated in implementing the solutions generated at the workshops. In addition, the healthcare workers indicated the use of an assistive device for each patient handling task by pressing one of two buttons on a console when leaving the patient (Green button: used an assistive device, Red button: did not use an assistive device).

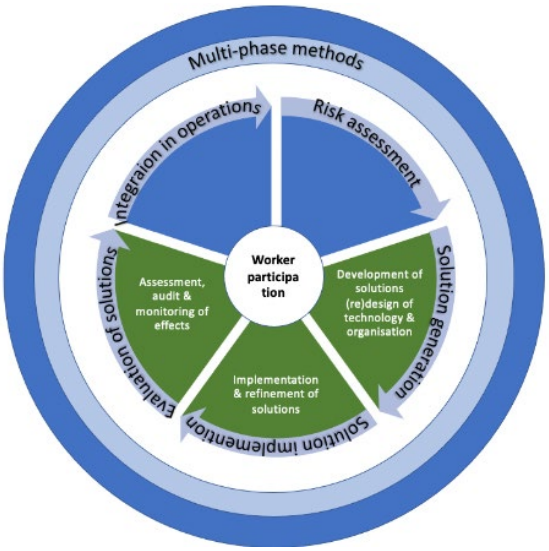
Results:

The intervention led to an increased use of assistive devices and improved communication and guidance about their use, but it did not lead to reductions in back pain or number of back pain injuries. In addition, user-manuals for assistive devices were successfully developed but often without the involvement of department managers. Large variation in the information communicated to the healthcare workers about the project was noted, as were the commitment and involvement of workers outside the workshops. The results indicate that the intervention works best when it is supported by management, when assistive device-use group policies are developed, and when time and resources are allocated to the implementation. This underlines the importance of the involvement and commitment of managers.

Method and approach:

This method is a multi-phase method, involving the participants in the phases: solution generation, solution implementation and evaluation of the solutions.

Method focus



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3.2.4 Redesigning a nursery with the involvement of workers

Sector: Human health and social work activities

Main method: Redesign of workstations (see section 2.4.7) and workplace with the help of workshops.

Key message:

When redesigning workstations, it is important to involve workers in the process of selecting new furniture and assistive devices to fit the needs of the workers and ensure sustainability of the solutions. In the presented case, redesign of workstations was conducted through participatory workshops and resulted in reduced MSDs.

MSE relevance:

Workshops are easily conducted in an MSE and can be adapted to all contexts. The redesign of workstations may involve increased costs due to procurement of equipment for the employer.

Level of Participation:

The presented case used both direct and indirect participation. Appointed workers observed typical work activities. All workers participated in subsequent workshops to discuss the redesign, and all of them participated in an ergonomics training workshop.

Country: Germany

Organisation:

A childcare centre with 100 children built in 1992 – about half of the children were younger than three years old.

Participants:

Workers with an educational background as childcare workers participated in the project.

Main health problem and hazards:

Working with children under the age of three years comes with higher risks of MSDs due to the manual handling of the children. More than half of the workers reported knee and back pain.

Main action:

Workers were consulted in advance about the procurement of new furniture. For activities that required prolonged sitting, chairs were acquired, which offered support for the spine and were adjustable in height. Objects that were moved often during everyday activities, such as tables or toy boxes, were equipped with wheels.

Participation:

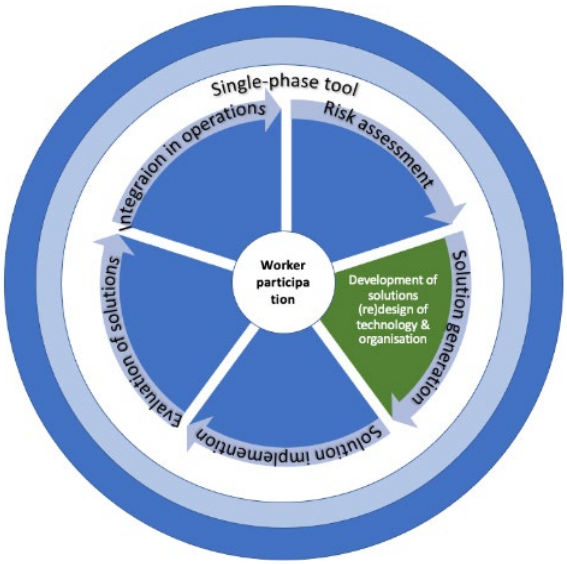
During their workday, appointed workers observed their colleagues to assess risk factors of MSDs. In a subsequent workshop, all the workers discussed how workstations could be redesigned and the consequence of the changes. In a second workshop, workers received ergonomic training about the use of the new furniture or tools. A post intervention survey of workers was conducted to evaluate the outcome of the intervention.

Results:

The intervention had multiple positive outcomes. Workers reported an increased use of assistive devices and an increased reflection on the risk of their work activities. In the post-intervention survey, workers reported a reduction in MSDs, in particular back and knee pain.

Method and approach:

This single-phase method uses direct and indirect participation in solution generation.



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3.2.5 Cooperative development of manual handling in an ambulance

Sector: Human health and social work activities

Main method:

Risk assessment and solution generation through discussions (see section 2.3.5) between different stakeholders.

Key message:

Close cooperation among departments and consultation of workers when introducing a new procedure ensures successful implementation.

MSE relevance:

Low		

The close cooperation with different professional groups could be relevant for MSEs, but the presented case involved specialised personnel, which may be costly for MSEs.

Level of Participation:

	Medium	

Direct participation in identification and prioritisation of the solution.

Country: Ireland

Organisation: The National Ambulance services

Participants:

The target group was ambulance staff. As part of the intervention, a project group was established comprising ambulance staff representatives, the fleet officer, the safety and risk manager, and an

education competency assurance officer. Input was provided by the medical director and national quality and patient safety manager. In addition, the vehicle suppliers participated in a number of the meetings.

Main health problem and hazards:

As part of patient clinical care, the ambulance staff use a defibrillator in the ambulance. Due to the position of the defibrillator, the staff experience awkward postures of the upper arms, forward bending of the trunk, rotated and stooped postures, and unstable postures when reaching to remove the defibrillator from the wall bracket, all of which cause MSDs.

Main action:

The project group and an ergonomist assessed the risk of the task and the project group developed a solution in close cooperation with operational staff and designers.

Participation:

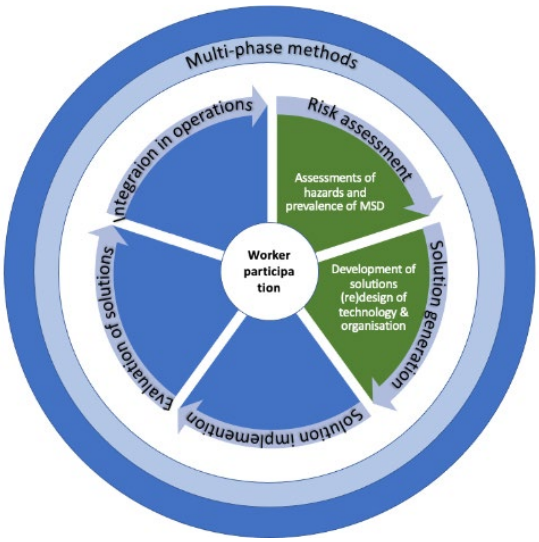
The project group did a risk assessment to quantify the ergonomic risk factors and to develop a solution. The group reviewed previous accident and incident data, training records, call data, and the existing procedures 'safe system of work'. An independent ergonomist reviewed the processes and assisted in conducting a risk assessment of the task. In addition, the project group consulted clinical and operational staff and the people who designed and fitted the defibrillator. As part of this phase, the project group explored better options in terms of relocating the defibrillator. After this process, the defibrillator was relocated. This took a number of visits to the fitters to ensure that the relocation was carried out in the existing fleet of ambulances and to ensure future proofing for new vehicles.

Results:

All stakeholders agreed that an important part of the intervention was the discussion of solutions. In addition, they pointed out the value of a close cooperation and consultation among the clinical and occupational departments when introducing a new procedure.

Method and approach:

This is a multi-phase method, which involved a risk assessment of the predefined work tasks and identified solutions.



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3.2.6 Role playing for nurses to increase the autonomy of patients

Sector: Human health and social work activities

Main method: Role playing

Key message: Role play can be used to increase the autonomy of patients and reduce manual handling loads for nurses.

MSE relevance:

Role play is low cost, does not require external consultants or specialised equipment, and leads to changes that are easily implemented. It can be used in all sectors and sizes of workplaces.

Level of Participation:

Workers identify work hazards and develop and prioritise solutions without restrictions.

Country: Italy

Organisation: Hospital setting

Participants: Nurses

Main health problem and hazards:

MSDs caused by manual handling of patients. One way to reduce the risks is to enable patients to move themselves or to assist in the move. These methods need to be practical for the patients and the environment suitable for their use.

Main action:

The nurses did role play, playing both the part of the nurse and the part of the patient.

Participation:

First, the nurses did role play and changed between playing the role of a nurse and the role of a patient to get a better understanding of the patient handling situations and the factors favouring and hindering patient handling. Afterwards, the results were discussed in the whole group of nurses.

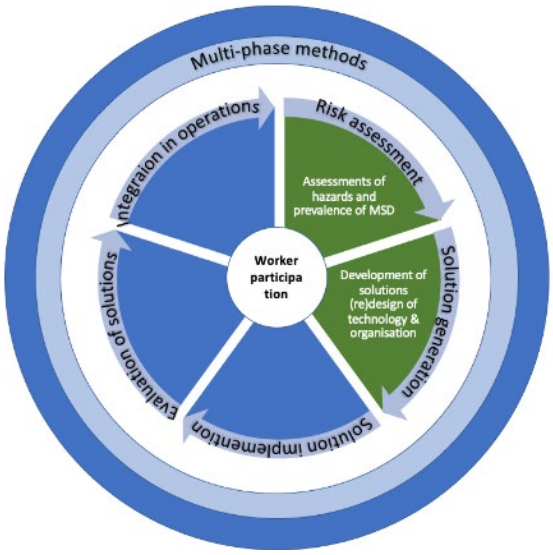
Through role play, the nurses examined risks, identified solutions, and developed new know-how based on the experiences of the role play. An important part of the process was the nurses were trained to teach the patients the best use of their physical abilities. This process also improved the nurses' interpersonal skills and communication with the patients.

Results:

This method eliminated the environmental, organisational and relational factors hindering the autonomy of the patient. Nurses experienced a reduction in physical effort of 39%.

Method and approach:

This method is a multi-phase model, as the participants are involved in the phases risk assessment and solution generation.



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3.2.7 Using ErgoPar in prevention of MSD in nurses

Sector: Human health and social work activities

Main method:

Participatory ergonomics based on and adapted from the ErgoPar method (see section 2.2.2). This included worker representatives in the Ergo Team, surveys to all workers and co-worker participation in preventive circles.

Key message:

MSDs can be prevented and managed in nursing staff by a multifaceted intervention (ErgoPar) using weekly meetings.

MSE relevance:

The ErgoPar method has been adapted to MSEs, but requires an external ergonomic consultant.

Level of Participation:

The method involved representatives of the workers, but a broader group of workers were also involved.

Country: Spain

Organisation:

Two public healthcare institutions with specialised acute care, psychiatry, long-term and primary care. Each hospital had about 4,000 workers of whom approximately 60% were nursing staff, and each had an experienced in-house OSH representative.

Participants:

257 nurses (63%) and nursing aids (37%) participated. The majority of the participants were women (84%) 31-49 years of age.

An Ergo Team consisting of a worker representative from each shift, a workers' union representative, the local OSH representative, and the unit supervisor was formed at each hospital.

Main health problem and hazards: MSD caused by heavy manual lifting of patients.

Main action:

The ErgoPar intervention consists of three phases: risk assessment (diagnostic phase), solution generation (treatment phase) and implementation. The Ergo Team took part in the participatory element of the intervention and were responsible for the development and implementation of the intervention. The group received basic training in ergonomics and participatory methods. The ergonomist managed weekly meetings and discussions for the Ergo Team.

Participation:

External OSH consultants (ergonomists) carried out the diagnostic phase in which they issued a survey on MSDs and risk factors to the workers.

In the treatment phase, the Ergo Team was established. The team had weekly 1-hour meetings for three weeks facilitated by the ergonomists. The first meeting focused on ergonomics training of the Ergo Team. In the second meeting, the team identified and prioritised ergonomic problems based on the survey results. In the last meeting, the Ergo Team developed a proposal for preventive solutions. In between these meetings, the worker representatives of the Ergo Team involved their co-workers in preventive circles in which the staff discussed the issues raised by the Ergo Team and provided input. The OSH representative and the department managers coordinated the implementation of prevention solutions.

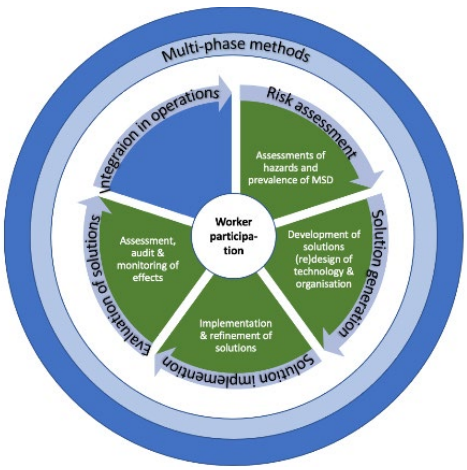
The implementation phase consisted of implementing organisational, structural, technical and training/information solutions. An 'operative group' composed of key managers was created, and they held monthly and bimonthly meetings to follow up on the process.

Results:

Preventive measures included organisational, structural, technical, and training/information improvements in the workplace. Most of the proposed measures were implemented, but the most expensive measures (such as staff recruitment, changing structure of rooms) and those that involved expansion of the workforce were not feasible to implement. The intervention resulted in reduced pain in the neck, shoulders and upper back.

Method and approach:

This multi-phase method involves the participants during risk assessment, solution generation, solution implementation and evaluation of the solution.



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3.2.8 Reduction of occupational risks among hospital orderlies

Sector: Healthcare

Main method: Participatory, action-oriented training workshops

Key message:

With a participatory intervention programme, it is possible to reduce physical risks in hospital orderlies. At the same time, the orderlies gain a better understanding of work postures and techniques, which helps to reduce MSDs.

MSE relevance:

Planning the participatory ergonomic intervention and programme training of orderlies to become facilitators requires assistance from external specialists.

Level of Participation:

All workers were invited to participate in the workshops and to contribute to the implementation of short-term and long-term improvement plans. The presented case uses both direct and indirect participation.

Country: Thailand

Organisations: Tertiary care hospital in Bangkok

Participants: 50 male hospital orderlies from patient transfer service participated.

Main health problem and hazards:

Orderlies suffer from high rates of back, knee and shoulder injuries associated with lifting, moving and transporting patients.

Main action:

The intervention programme consisted of three workshops. The first included training of volunteer orderlies to become facilitators and development of an ergonomic manual. The second workshop (six hours) included all workers and focused on worker education, risk assessment, solution generation (see section 2.3.7) and implementation. Six months later, three hours were scheduled for the last workshop that focused on evaluation and the sustainability of the solutions.

Participation:

In the first workshop, ten volunteer workers (facilitators) received training on basic ergonomic principles and process facilitation. Afterwards, the facilitators discussed the development of a basic ergonomic manual and provided feedback on educational materials for orderlies.

In the second workshop, all orderlies invited were asked to identify three elements of best practice and three elements in need of improvement in an action checklist. Group discussion followed and best practices were shared. The last hour of the workshop was dedicated to developing short-term (1-2-

month) and long-term (3-6-month) action plans for each unit. In addition, the participants received education on MSDs and the educational material.

The third workshop focused on the evaluation of improvements and achievements. Worker representatives presented outlines of the short-term improvements. All relevant stakeholders were invited to attend this workshop. The workshop was concluded with a contest of best achievements.

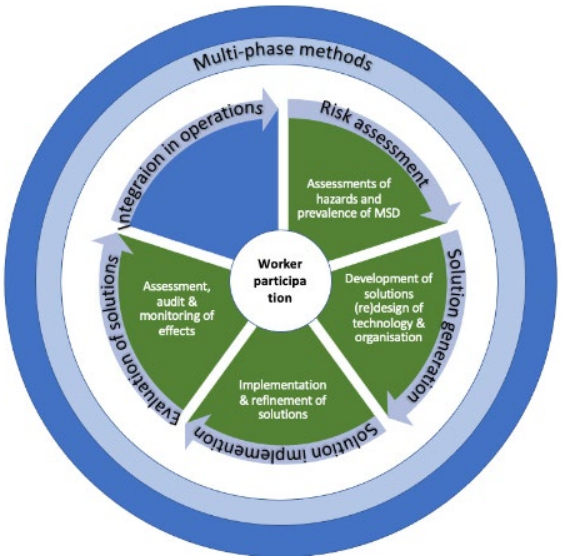
Between the second and third workshop, the external specialists (researchers) visited the units to monitor the progress and encourage workers to continue with improvements.

Results:

Two months after the intervention, the workers had carried out 28 work improvements covering a broad scope of areas including patient care, safe handling and transfer of patients, medical devices, equipment, workstation redesign, and administration. Overall, the changes led to decreased risk exposure level scores for the back and neck and a reduction in sick leave due to MSDs.

Method and approach:

This is a multi-phase method. During the workshops, the orderlies carried out risk assessments, solution generation, implementation and evaluation.



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3.2.9 Involving home care aids in ergonomic and safety improvements

Sector: Home health aide / healthcare sector

Main method: Workshops, which included brainstorming of prevention ideas and face-to-face individual discussion.

Key message:

Ergonomic interventions developed in workshops by home health aides can help reduce the aides' exposure to MSD risk factors.

MSE relevance:

The ergonomics intervention requires an ergonomist specialist to conduct the risk assessments, one-to-one discussions and facilitate the workshops.

Level of Participation:

Workers were involved in risk assessment and in solution generation, pilot testing of developed intervention as well as in implementation strategies.

Country: United States

Organisation:

Inc. dba Interim HealthCare is a large home healthcare company that has offices in the Midwestern region of the USA.

Participants: Home health aides and nurses

Main health problem and hazards:

Home health aides are exposed to risk factors causing injuries and MSDs, including lifting objects, rubbish disposal, injuries related to patient handling, repetitive tasks, and pushing, pulling, lifting, lowering and carrying.

Main action:

An ergonomic specialist conducted an analysis of injury data, in-home observations, and analysis of aide-patient interactions, and engaged the workers in one-to-one discussions with experts in during the observations. The home health aides participated in two workshops to validate and discuss the findings from the one-to-one discussions and observations and brainstorm potential solutions. Finally, they tested the solution and provided feedback (see section 2.4.8).

Participation:

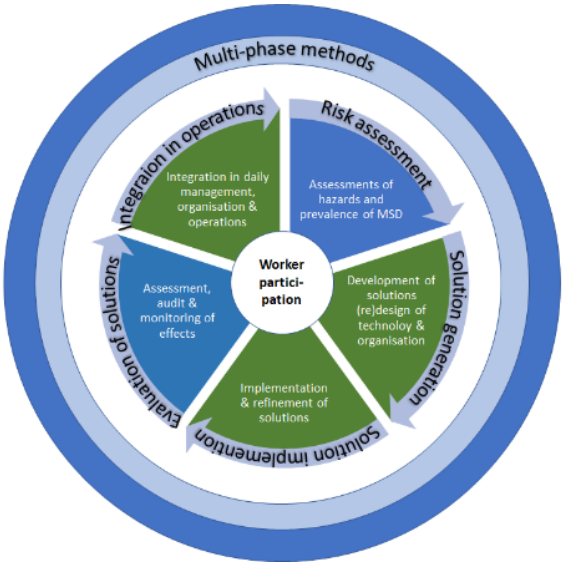
In the one-to-one discussions with the external specialist, workers were asked to analyse their main tasks and physical exposure in relation to the interaction with the patient. To provide additional verification and prioritise the tasks and exposures identified in the direct observation, the participants took part in two workshops concluding with a brainstorming session to generate and discuss intervention ideas. Finally, workers pilot tested the solutions, and provided written and oral feedback on the solutions in weekly discussion sessions.

Results:

The most important outcome was a re-organisation of the work schedule to minimise the home health aides' exposure to higher needs patients. The home health aides developed and tested a method for categorising patients and a system for scheduling the work that reduced the aides' exposure to risk factors for musculoskeletal injuries.

Method and approach:

This is a multi-phase method. The workers participate in the development, pilot testing and implementation of solutions.



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3.2.10 Positive emotions during care of disoriented patients

Sector: Human health and social work activities / healthcare (psychogeriatrics)

Main method: Training, discussion of practice and workplace changes

Key message:

Training, observation, feedback and group discussions help caregivers develop relational skills that lead to improved work practice and reduction in MSD hazards.

The method requires a trainer qualified to apply the method.

Level of Participation:

The trainees develop implementation strategies by observing the trainer and other trainees and reflect upon their own practices.

Country: Canada

Organisation:

Several residential and long-term care centres and a Canadian OSH institution dedicated to the social sector (Association paritaire pour la santé et la sécurité du travail du secteur affaires sociales, ASSTSAS).

Participants: Caregivers and nurses working with disoriented patients.

Main health problem and hazards:

Taking care of disoriented people with loss of autonomy is a daily challenge for caregivers, particularly during the toilet work activity. This activity involves assistance of patients with movement, undressing, care procedures, dressing and, depending on the case, installation in a wheelchair with or without mechanical assistance. It takes place in bed, at the sink, in the bath, or in the shower according to the

client. This increases the MSD risk and stress for the caregiver. The most frequent injuries are to the back.

Main action:

Training in an interpersonal relational approach in nursing care was deployed in residential and long-term care centres. This training teaches caregiver-patient communication and techniques to change behaviour in the care situations. The training is based on the positive emotion that the trainees experience by observing a trainer in real care situations and by carrying out the techniques themselves. The training combines theory and practice and is used for groups of caregivers.

Participation:

During the first two days of training, and in front of the rest of the group, the trainer guides a caregiver through a care situation (bathing) using the techniques. Then, the group discuss the process (see section 2.3.5) and analyse observed outcomes. During the following two weeks, the trainees experiment with these new learnings in their routine work. In the next step, the trainer guides each trainee separately in performing two different care situations (personal hygiene) followed by an exchange between them on the integration of the training principles in the trainee's work. Finally, a half day is organised with the initial group and trainees share their experience of the training. During all steps, suggestions to management relating to work organisation, material and workspace are put forward by the trainees.

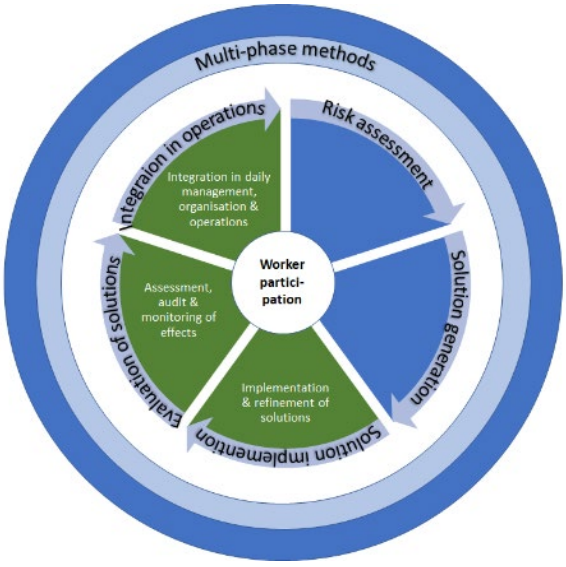
Results:

An assessment of the training using a questionnaire completed by 392 participants showed that:

- The training gave caregivers tools to carry out the care process even more gently.
- The training allows for a more harmonious relationship with patients.
- Improved patient autonomy allows for safer work.
- Improved communication with the patient leads to improved job satisfaction.

Method and approach:

The training is learning by doing. During the training, workers participate in solution implementation. They evaluate the new process during practice, and then integrate this new process into their work.



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3.2.11 Health promotion through the FireFit assessment method

Sector: Public services

Main method: Group discussions about health and work ability.

Key message:

Participating in the FireFit assessment and discussions about the findings motivates firefighters to stay fit through shared understandings of health promotion and work ability. The method provides an informal, experimental and social basis for workplace actions and facilitates a positive atmosphere and workplace culture.

MSE relevance:

The organisation needs a person trained in the FireFit method and familiar with work tasks of rescue services. Training is provided by a research centre.

Level of Participation:

This method has a medium level of participation of workers. Based on assessments of test results, workers engage in discussion about health, and prioritise and choose the topics they feel are most important to discuss

Country: Finland

Organisations: Fire and rescue departments

Participants: Firefighters from 21 regional rescue services

Main health problem and hazards:

The most common reasons for early retirement among firefighters are MSDs (44%) (data from Finland, 2010-2016). Thus, maintaining and promoting physical work capacity is particularly important.

Main action:

FireFit is a computer-based system for assessment, feedback and follow-up of physical work capacity of firefighters. It compares the firefighters' physical work capacity with the requirements of the job. Based on the comparison, the system interactively provides guidance to individual firefighters on how to maintain and improve their physical functioning. Yearly, central workshops are organised to discuss the FireFit tests, and firefighters are asked for feedback to improve the system. On-site group discussions are organised to discuss the test results and implications.

Participation:

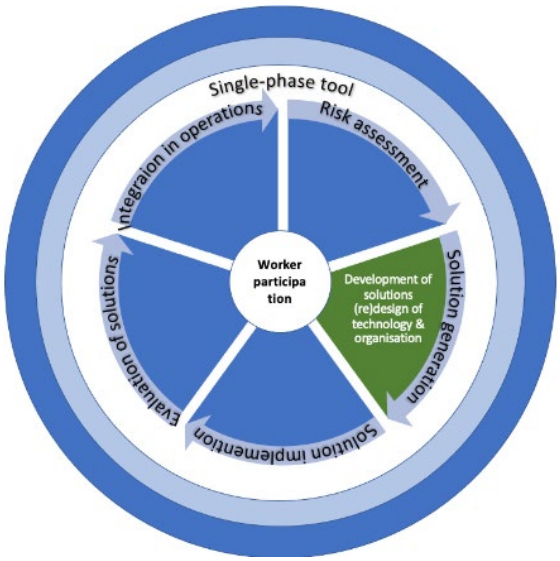
In 2006, researchers form Finnish Institute of Occupational Health developed the FireFit method, and since then, firefighters' suggestions have led to gradual updates. As a group activity, the firefighters take on the physical fitness tests and discuss the results (see section 2.3.5). This process facilitates a workplace culture and atmosphere in which physical fitness, healthy lifestyle and work ability can be openly discussed.

Results:

The FireFit method has been in use since 2006, and since then, the method has been gradually improved according to firefighters' suggestions. The FireFit method allows for early, more appropriate and better targeted interventions for firefighters with decreasing work ability. Premature retirement of this highly specialised workforce can be avoided.

Method and approach:

This is a single-phase tool. The firefighters actively participate in the continued development of the tests, take the tests, and participate in discussions about health-related topics with their peers.



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3.3 Sector: Manufacturing

3.3.1 Using the ErgoPar with operators in motor vehicle manufacturing

Sector: Manufacturing

Main method:

ErgoPar method (see section 2.2.2), including a working group, questionnaires and worker preventive circles.

Key message:

The ErgoPar participatory ergonomic programme can be implemented in workplaces in agreement with workers and management of the company. The programme leads to improvements in working conditions that are adapted to the specific problems and conditions of individual companies.

MSE relevance:

This method has a medium relevance for MSEs. The approach is facilitated by an ErgoPar methods specialist. This may be an external consultant or in-house staff member with in-depth knowledge of the ErgoPar method. Training in the ErgoPar method is offered by external organisations, and adaptations of the method for SME are available.

Level of Participation:

This method has a medium level of participation – it can be direct or indirect. Support from the top management is crucial for commitment and for allocation of resources needed for the intervention. The preparation and capacity building of the Ergo Team is an important prerequisite of a successful ErgoPar intervention. Workers were involved through a questionnaire, the worker representatives on the Ergo Team and during preventive circles.

Country: Spain

Organisation:

An international manufacturing company of automotive parts (clutches, engines and windshield rods) employing 320 workers.

Participants:

Male workers mostly 34-45 years of age from the press department. The department is responsible for a variety of tasks such as unloading of trucks, press, using an overhead crane to feed the production lines, and manual unloading of finished parts.

Main health problem and hazards:

Workers complain of musculoskeletal discomfort and pain in the legs, lumbar spine and shoulders.

Main action:

Application of the ErgoPar holistic 3-step participatory approach to improve the working conditions based on ergonomic principles.

Participation:

To begin the process, management of the company and worker representatives formalised an agreement about applying the ErgoPar method. Guided by the ErgoPar specialist, an Ergo Team was formed consisting of worker representatives and a health and safety specialist, and with the department area manager as interlocutor. The Ergo Team received basic training in ergonomics and the ErgoPar methodology from the ErgoPar specialist. To assist the Ergo Team, the production line workers filled in a self-report questionnaire on the prevalence of MSDs and work-related risk factors. The Ergo Team started by evaluating the questionnaire-based information on MSD-related hazards and exposures at the selected working lines. Next, the Team organised preventive circles with direct participation of production line workers. The preventive circles consisted of discussion groups guided by members of the Ergo Team with the aim to reach a consensus on the causes of the risk factors identified in the questionnaires. Together with the workers, the Ergo Team came up with preventive measures, which were implemented at different rates. Afterwards, the company's health and safety committee, which includes worker representatives, used the results to define a continuity strategy.

Results:

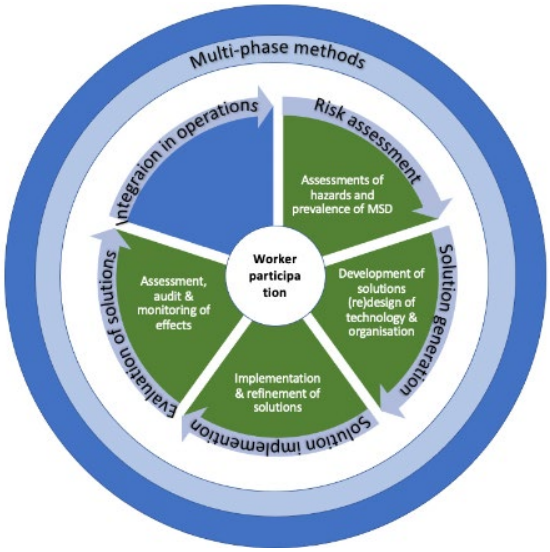
The Ergo Team and production line workers identified the following causes of MSDs and preventive measures:

- Exposure to ground-borne vibrations was reduced by introducing individual anti-vibration mats.
- Awkward work positions of the lumbar spine were reduced by replacing a manual trolley with a motorised trolley. Manual handling of heavy loads was reduced by a mechanical lifting device.
- Working positions with the arms above shoulder height were limited by slightly modifying the product. Manually operated machinery was replaced with automated machinery. In addition, suppliers of the auto parts were made to deliver the parts so that they were easily accessible and easier to handle.

The costs of investing in technical measures were considerable, and the measures were implemented over the short, medium and long term. Since the implementation of the preventive measures in 2018, there have been no reports of work accidents related to the lumbar spine or shoulders.

Method and approach:

ErgoPar is a holistic participatory approach. The presented case represents multiple phases including risk assessment, solution generation, implementation and evaluation, but not integration in operations.



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3.3.2 Workshops for edible oil workers to generate solutions

Sector: Manufacturing

Main method: Workshops

Key message:

Workers from across all sections of a company can be successfully assembled in workshops to identify problems and develop improvement ideas. This increases workers' engagement in managing health and safety. A steering group comprising worker representatives, management, work councils and labour unions who work together can solidify a project plan and ensure support for the workplace changes.

MSE relevance:

The initiation of workshops requires limited resources such as time, material and personnel for the employer. The establishment of a steering group responsible for the organisation of activities is crucial.

Level of Participation:

The presented case used both direct and indirect participation through worker representatives in the steering group. All workers were invited to contribute to the problem identification as well as the identification of solutions during the subsequent workshops. The case also entails direct participation as all the workers were invited to contribute to the problem identification and solution generation.

Country: The Netherlands

Organisation: A supplier of edible oils with 450 workers.

Participants: All workers were invited to join the workshops. Appointed workers participated in the steering group.

Main health problem and hazards:

Shift work, unhealthy lifestyle and a lack of sustainable employment.

Main action:

A company steering group facilitated change activities and workshops in which workers were invited to identify workplace problems and potential solutions. Three improvement teams generated solutions and implementation plans.

Participation:

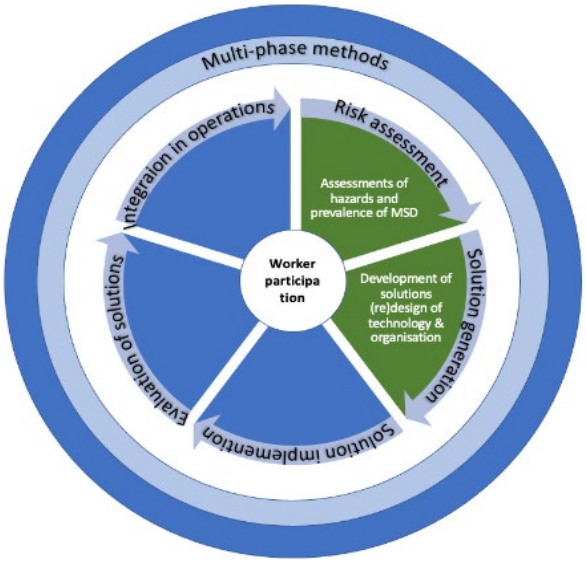
A steering group was set up comprising workers from all sections, management and HR representatives as well as selected members of the workers' council and labour union. The steering group was responsible for facilitating change activities, and for creating trust amongst the company staff to engage in the workshops. All workers were invited to workshops, with the aim of identifying workplace problems and proposing solutions. Based on the problem identification, three improvement teams were formed to develop mitigating measures.

Results:

This process led to the introduction of part-time work and job sharing. Also, the company started to offer events for workers on themes such as exercise, nutrition and relaxation. The improvement teams continued to manage risks after the end of the intervention period. The participatory approach of the intervention led to a high degree of worker involvement and engagement in the developed measures.

Method and approach:

This multi-phase method used direct and indirect participation in risk assessment and solution generation.



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3.3.3 Engaging workers in physical exercise sessions and discussions

Sector: Manufacturing

Main method: Exercise sessions/workshops

Key message:

Back Schools may provide individuals a theoretical and practical knowledge of prevention and self-management of back pain. Physical exercise sessions and discussions help to actively engage workers in their own health.

MSE relevance:

The method has a medium relevance for MSEs. It requires an external consultant with expertise in physical exercise and MSDs to hold the workshops and instruct the workers in exercises.

Level of Participation:

This method has a low level of participation. The workers volunteered to participate in the training sessions/workshops and later continue regular exercises at home individually, but they were not actively involved in preparation of the workshops or the content. However, training sessions can also be used as a forum to gather information from workers about hazards and suggestion for improvements.

Country: Czech Republic

Organisation: A small clothing company

Participants:

15 female seamstresses with an average age of 49 years and average duration of employment of 19 years.

Main health problem and hazards:

Seamstresses are at high risk of back pain due to prolonged forward flexion of the neck and trunk. In addition, they have repetitive hand movements and high visual demands. In this example, the seamstresses complained about low back pain. The owner of the company turned to an occupational health centre and sought help from a physiotherapist to improve the workers' health.

Main action:

The physiotherapist conducted 6 morning sessions of physical exercise and workshops with a theoretical and practical part. Each session lasted 1 hour followed by 30 minutes of discussion and feedback.

Participation:

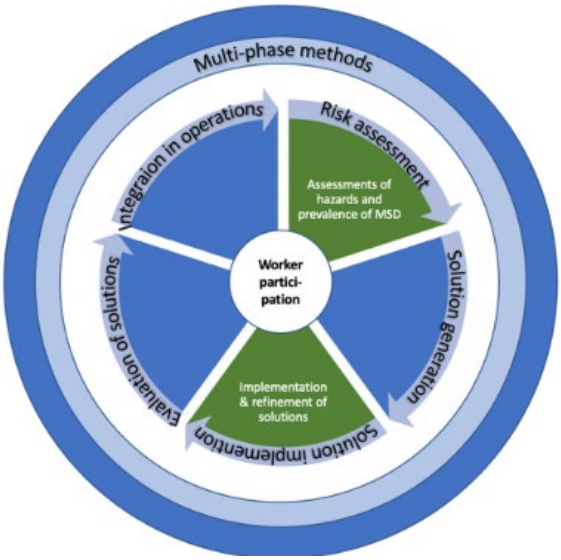
The seamstresses were divided into smaller groups to make sure that all participants got individual feedback during the sessions. The physiotherapist tailored a 7-10-minute exercise programme according to individual needs of the workers and instructed the workers in the exercises. During the last two sessions, the programme was practiced. In the theoretical part, the participants explained their back problems and the physiotherapist commented. Discussions were facilitated to promote the understanding that regular exercises can reduce/prevent MSDs and to identify other possible solutions to back problems.

Results:

The study indicated that introduction of the Back School led to improvement of subjective findings in almost half of the sewing operators. The Back School increased the motivation of the seamstresses to continue the exercise programme at home. Before attending the Back School, 86% of the participants did not exercise. After 6 months, 80% continued the exercises.

Method and approach:

This is a multi-phase method. During the exercise workshops, the participants participated in assessment of their back problems (risk assessment phase). Afterwards, they participated in solution implementation by continuing the exercise programme at home (see section 2.3.7).



References:

Unpublished intervention provided by the EU-OSHA Czech Republic focal point.

3.3.4 Lifting aids for workers in dairies

Sector: Manufacturing

Main method:

Worker task forces from a network of organisations investigated a technical solution. Workers tested the prototypes for designs of a new device.

Key message:

A strong and open collaboration between the involved stakeholders leads to the development of new assistive equipment that reduces workload.

MSE relevance:

Low		

This method may be of limited relevance for MSE's, as an external manufacturer of a prototype and the final device was involved. Further, an external occupational safety and health consultancy was involved.

Level of Participation:

	Medium	

This method has a medium level of participation, as the workers were involved in developing and testing the prototypes.

Country: Denmark

Organisation: An occupational safety and health network consisting of 16 small dairies.

Participants:

Worker representatives and managers from each dairy, and an occupational safety and health consultancy.

Main health problem and hazards:

Workers at dairies are exposed to various physically demanding work tasks, especially heavy lifting and awkward positions, which causes pain and fatigue in the body.

Main action:

Establishment of a network of small diaries and task forces of worker representatives to develop and test prototypes (see section 2.4.8) of a new tool for lifting assistance that would reduce heavy lifting of cheeses, buckets and cans and when packing.

Participation:

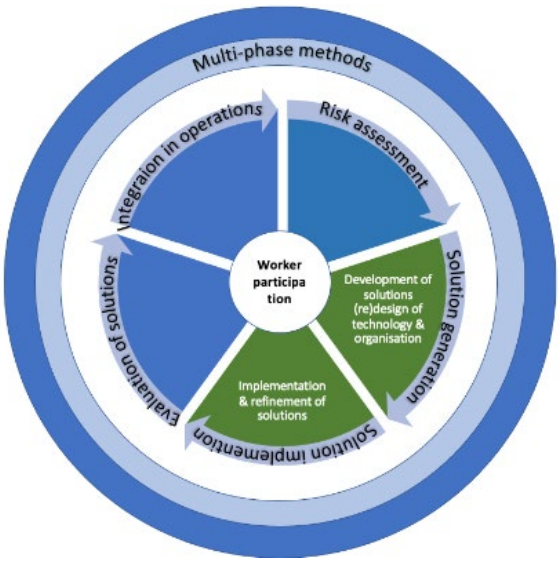
The occupational safety and health consultancy guided the process of forming a steering committee and a network of 16 diaries that were contractually committed to working together on developing a new tool that lifts different objects and thereby reduces manual lifting by workers. The steering committee selected three dairies to test the prototypes. At each of the 16 dairies, worker representatives formed a task force. Each of the test-dairies had 2-5 task forces from the other dairies assigned to them as co-creators and to provide feedback. Together, the task forces and the occupational safety and health consultants selected an external manufacturer to produce a prototype of a tool that would reduce the load and repetition of lifts. Five workers at the test-dairies tested three iterations of the prototype for five weeks before the final tool was agreed upon.

Results:

The process led to creating a device that removed the need for manual lifting, as workers instead just have to connect and control the tool. Using the tool has led to a reduction in heavy lifting of 10,000 kg a day, which reduces the workers' muscle fatigue in the upper body. Satisfaction with the new tool varied among workers, and some workers found the tool disruptive to the workflow. The formation of a formalised network and the sense of a strong community motivated the dairies to collaborate.

Method and approach:

This method is a multi-phase method. In cooperation with the manufacturer, the workers were involved in solution generation, development and testing of the device.



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3.3.5 Wellbeing at work with the 'Good work – longer career' project

Sector: Manufacturing / technology industry

Main method: Discussions and the introduction of continuous weekly meetings to deal with new issues.

Key message:

Risk assessment followed by weekly worker meetings are effective in reducing MSDs and sickness absence in technology companies.

MSE relevance:

The implementation of the methods is highly relevant for MSEs, as in-house personnel can facilitate the process. The process requires time for discussion and weekly meetings.

Level of Participation:

Workers participated in several phases starting with the identification of the problem (risk assessment) to generating the solutions.

Country: Finland

Organisation:

Oy SKF Ab, Muurame factory (technology company) in collaboration with Finnish trade unions.

Participants:

Workers from more than 50 Finnish technology companies. The entire production personnel at a single company participated in the presented case.

Main health problem and hazards:

MSDs, accidents and mental health disorders are frequent causes of both long- and short-term sick leave in the technology industry.

Main action:

A series of common discussions (see section 2.3.5) with workers to set targets on how to improve workers' wellbeing. Training was arranged and weekly meetings were introduced. Worker surveys were also used at the beginning.

Participation:

Two surveys were conducted among workers. A project team was established comprising management representatives, health and safety staff, occupational healthcare personnel, and trade union members. Based on the survey results, production personnel discussed and gave feedback on how to improve workers' wellbeing. Weekly meetings with workers were introduced to solve recurring problems within the work team and deal with emerging issues. Management invested in machinery and safety equipment, and workers received training in safety at work.

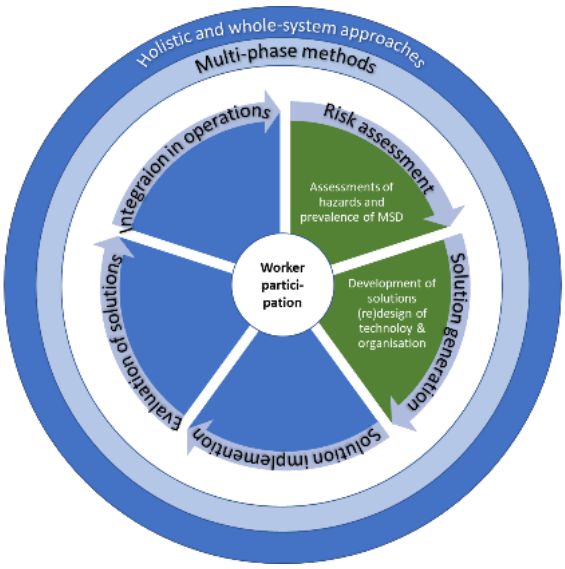
A range of measures was introduced covering different types of hazards. For example, investment was made in machine and lifting safety, and employees were trained in safety at work.

Results:

Workers' wellbeing and motivation at work increased, while sickness absence decreased. Payments into statutory accident insurance fell by 17%; and there were no accidents reported in the following 18 months.

Method and approach:[p;'./

Participatory design is a multi-phase method where workers participate in risk assessment, solution generation (see section 2.3.7) and implementation, and integration in operations.



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3.3.6 Industry-University Collaboration on Participatory Ergonomics

Sector: Manufacturing

Main method: Training in ergonomic methods

Key message:

An international, company-specific ergonomics programme involving the entire chain of command, a training plan in ergonomic methods for all workers, and the contribution of external specialists leads to reduction in MSDs.

MSE relevance:

Low		

The programme is comprehensive and requires internal and/or external ergonomic specialists.

Level of Participation:

		High

Workers are involved in problem identification, solution generation and implementation strategies.

Country: France, United States, Canada and Mexico

Organisation: The presented cases took place in the North American sites of the industrial group Safran.

Participants:

Direct and indirect participation of the entire chain of command – from managers to workers.

Main health problem and hazards:

MSDs from awkward postures, repetitive movements and manual handling are prevalent in manufacturing work.

Main action:

The Safran group has developed an ergonomics programme in France that was implemented on the North American continent (USA, Canada, Mexico). Different levels of training in ergonomics (see section 2.3.7) were provided by a university professor to workers. Each level included a didactic and practical part. Training took place in the company to incorporate real-life work situations. In parallel, the professor conducted an ergonomic work analysis, which was discussed with the workers.

Participation:

The Safran group programme consists of four levels of ergonomics practice targeting different workplace actors:

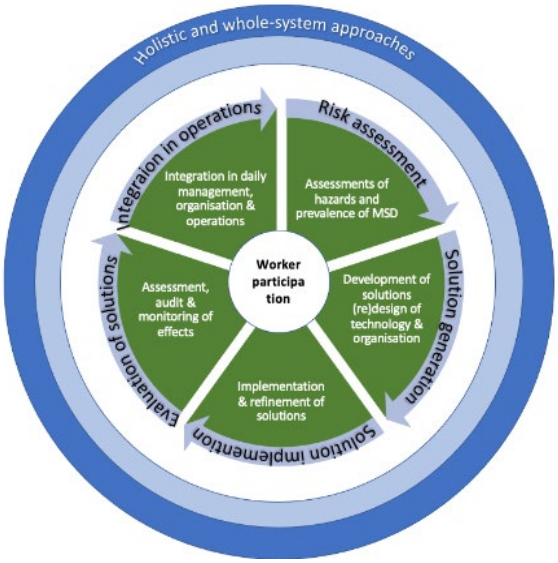
1. Operators, supervisors and OSH counsellors receive a three-day training programme on physical risk prevention and are expected to contribute to risk detection and assessment, and solution generation. In five years, 1,500 workers have been trained.
2. Selected workers are trained for more complete analyses of workstations, or to select priority workstations, follow action plans, provide support in the design of tools or workstations. In five years, 180 workers have been trained.
3. Project managers, engineers and OSH actors are trained as designers of workstations. In three years, 350 designers have been trained.
4. Special training for professional ergonomists. The group employs 18 ergonomists and call on numerous ergonomics consultancies.

Results:

The programme has resulted in a decrease in accidents (-29% worldwide) and MSD reports (-25% in France). Ergonomics are systematically integrated in the group's investment projects. Collaboration with a university partner facilitated improvements of training content, adjustment of assessment tools, and employment of ergonomists.

Method and approach:

The Safran ergonomics programme is a holistic approach that employs all phases of participation and involves a diversity of workplace actors. The long-term approach has led to successful outcomes in terms of MSD prevention.



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3.3.7 Towards a holistic approach to MSD and psychosocial risks

Sector: Manufacturing / production line

Main method: Workshops

Key message:

The combination of a steering group with worker representatives and key stakeholders and involvement of all workers in working groups led to improved overall working conditions and reduced MSD risks.

MSE relevance:

An ergonomic specialist is required to do the risk assessment and to train workers in ergonomics and prevention of health risks.

Level of Participation:

Problem identification, solution generation and implementation are made by workers.

Country: France

Organisation: Private company with 100 workers belonging to a large industrial group.

Participants:

Operators (women with a high level of seniority), production manager, supervisors and a methods technician.

Main health problem and hazards:

Following the implementation of a new organisational model based on lean methodology, an ergonomist identified several MSD hazards: intensification of work with increase of production rate, deterioration of teamwork and more repetitive tasks.

Main action:

The company implemented a prevention process based on a global approach with the aim of strengthening the collective efforts of workplace actors in designing healthy work situations. Following the external ergonomist's risk assessment, an action plan was defined in focus groups (see section 2.3.1). Once the action plan was presented to the management committee, working groups were formed to implement the various solutions that aimed at transforming work situations and developing the dynamic of collective work.

Participation:

Two focus group meetings involving two workers, a production manager, a workshop manager, and a methods technician were conducted by an ergonomist. The ergonomist presented the results of the risk assessment. Next, the same group met without the ergonomist to develop an action plan.

A management committee and a steering group composed of two workers, an occupational health physician, a union worker representative and an OSH institution representative approved the action plan.

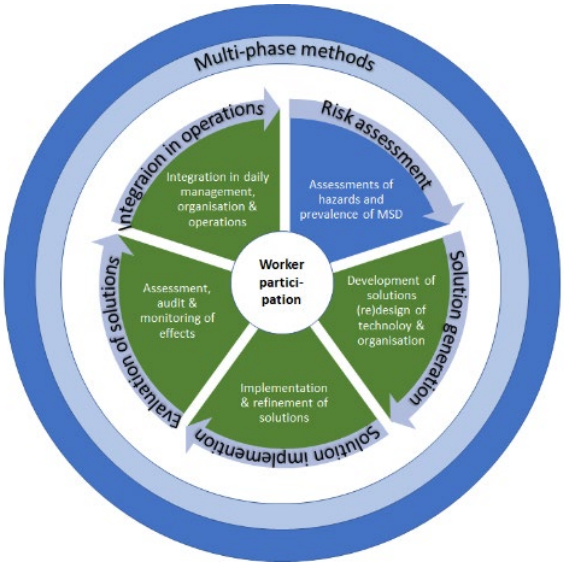
In two meetings with all workers, results of the risk assessment and the action plan were presented and discussed. The company established several working groups where each worker participated in at least one of the working groups. Each group included a volunteer worker trained as a facilitator and in ergonomics. The groups' goals were to identify immediate improvement actions as well as proposals for longer-term changes related to workstations and work organisation. One of the working groups had the task of preparing the implementation of the solutions.

Results:

The transformation process was based on the collective work of workers from all functions of the company (production, maintenance, methods, and others) who participated and contributed their opinions. This approach allowed each worker, whatever their position, to experience the limitations of others and the need for mutual adjustments.

Method and approach:

The approach used in this case is a multi-phase method.



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3.3.8 Analysis of work postures and movements in a training situation

Sector: Manufacturing / automotive supplier (industry/production line)

Main method: Self-confrontation with video

Key message:

Videos of workers at workstations, workers' self-confrontation with video and solution identification adapted to the work situation and worker characteristics facilitates OSH awareness in workers and management.

MSE relevance:

The method requires a trainer qualified to apply the method.

Level of Participation:

Problems and solutions are identified by each participant through debate (see section 2.3.3) among the workers about work practices and movements along with their health impacts.

Country: France

Organisation:

A manufacturer of automotive parts and ANACT (Agence nationale pour l'amélioration des conditions de travail, a French Occupational Safety and Health institution).

Participants:

This method can be applied to any team of workers for whom work postures and movements are a cause of MSDs.

Main health problem and hazards:

The company has an ageing workforce, and one-third of the workers are affected by MSDs and consequent restrictions in their work.

Main action:

ANACT has created a training module for occupational safety and health (OSH) actors about biomechanical and psychosocial dimensions of work postures and movements using video recordings of actual work situations (see section 2.4.4). The objective of the module is to develop a better understanding of work postures and movements and use this understanding to adapt work situations to reduce strain.

In this case, the training is based on a video of a work situation of a worker at an automotive supplier.

Participation:

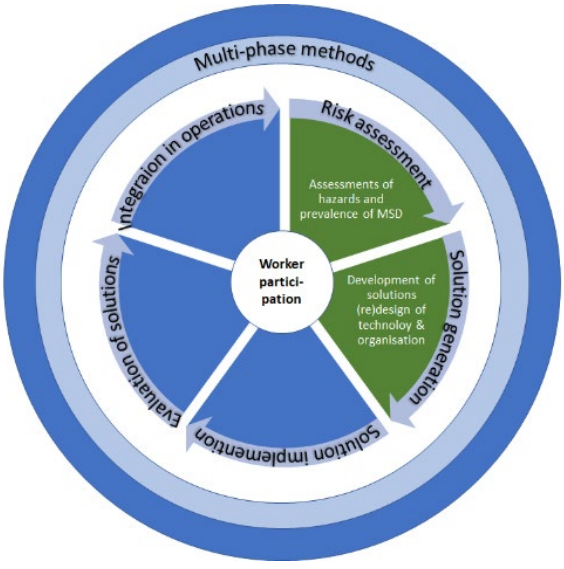
An appointed or volunteer worker completed the training module to become an OSH trainer. The trainer then made a video of a selected work situation, showed it to co-workers and presented an analysis of the work situation. Next, the video and the analysis were discussed with the workers to develop an understanding of why the workers were doing each operation in a specific manner and how this understanding of the work postures and movements could be relevant for MSD prevention. The search for the intentions and explanations behind the work postures and movements helped the workers ask questions about work organisation, identify risk factors and potential solutions.

Results:

This approach highlights the work organisation so that the logic behind postures and movements becomes apparent. This will encourage companies to address work organisation issues and support improvement of work postures and movements from an MSD prevention perspective.

Method and approach:

Workers assess hazards and generate solutions in a preventive perspective.



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3.3.9 A participatory approach for integration of an exoskeleton

Sector: Manufacturing / automotive industry (private sector)

Main method:

Participatory implementation of a new technology involving a small group of workers in the selection and testing of different equipment options. Methods included interviews with workers at the start of the intervention, user testing, evaluation forms and workshops to gather opinions.

Key message:

Direct participation of workers in implementation of a new technology, including choosing tasks with high physical load, testing and evaluation of exoskeletons in work situations to reduce MSDs and increase workers' OSH skills.

MSE relevance:

An occupational health advisor is needed to facilitate the process. SMEs may require financial assistance to purchase the exoskeletons. The process requires time for training, testing and weekly workshops.

Level of Participation:

Workers participated in all phases of the process from risk assessment to implementation strategies. As the introduction of an exoskeleton changes the organisation, the voluntary commitment of the entire team is required.

Country: France

Organisation: Volvo, INRS (French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases)

Participants: Workers at workstations with a high physical load and/or significant MSD risks.

Main health problem and hazards:

MSDs account for nearly 90% of all occupational diseases in the company. Shoulder disorders account for 41%.

Main action:

The company used an internationally recognised INRS method for implementing exoskeletons. Using interviews and observation, an ergonomist identified tasks with high physical load. Based on the findings, several exoskeleton models were identified. Workers tested (see section 2.4.8) and evaluated the exoskeletons in several iterations using structured questionnaires and workshops.

Participation:

During interviews with the ergonomist, workers gave input on the tasks and workstations requiring physical support. After selection of different exoskeleton models, volunteer workers performed short tests of 20-30 minutes using the exoskeletons at selected workstations. The ergonomist and the

participants identified several tasks and workstations for which it was feasible to use an exoskeleton. Four workstations were selected for further testing.

Next, the ergonomist organised weekly workshops for each workstation with volunteer operator-testers, operator non-testers, a manager and an occupational health physician. Operator-testers made short tests of several exoskeleton models. The workshop participants assessed the human-exoskeleton interaction on five criteria: appropriation, utility, usability, impact and safety, and eventually shortlisted two workstations for further tests.

Five volunteer operators carried out a 5-week exoskeleton trial. The first week of testing was a learning period done off-line for at least one hour per day. During the next 4 weeks, operators systematically evaluated the exoskeleton by indicating their level of exertion on a form. Moreover, operator-testers had the opportunity to discuss their experience during weekly workshops.

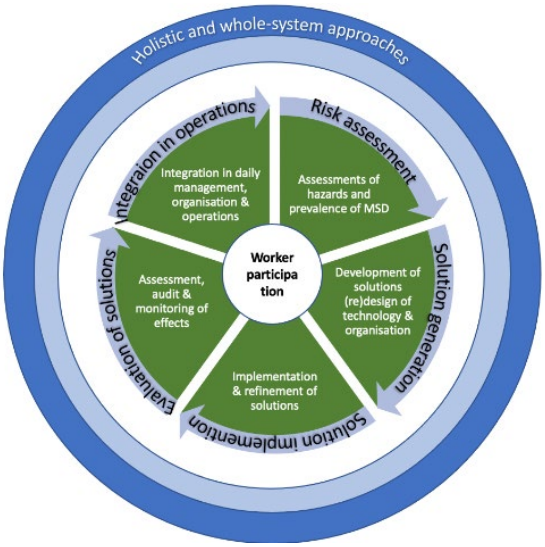
Results:

After 5 weeks of using the exoskeletons, pain or discomfort in the shoulders and upper back disappeared, and the level of exertion was strongly reduced.

The participatory approach facilitates knowledge exchange among the operators, and among operators and their managers. It also encourages the exchange of good practice, learning of new work strategies (process, gesture) and development of skills. The operators played an active role in assessment and testing and became actors in their own occupational safety and health.

Method and approach:

Participatory design is a holistic approach where workers participate in all phases from risk assessment to integration in operations.



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3.3.10 Participation in design and implementation of OSH policies

Sector: Manufacturing

Main method: Workshops and training

Key message:

Workshops can be used to increase awareness of health problems and risks related to an ageing workforce. To connect workshops with specific activities that support the company´s health and safety policies and procedures, an external consultant can be helpful. The commitment of management and team leaders is essential to start the process of change.

MSE relevance:

The described actions require skills and knowledge that can be provided by an external consultant or an OSH professional.

Level of Participation:

Workers were involved in the design and implementation of new health and safety practices and policies.

Country: Germany

Organisation:

The company is a manufacturer of sheet-fed offset printing presses with 7,000 workers in Germany. More than half of the workers are aged 50 or over. The company projects that, even if it hires predominantly young workers for the next 15 years, this demographic situation will not change significantly.

Participants: 3,500 participants, more than half aged 50 years or over.

Main health problem and hazards:

The company's production is characterised by highly repetitive tasks and painful postures (such as standing for long periods), leading to back, neck and shoulder pain. Moreover, the company is challenged by an ageing workforce.

Main action:

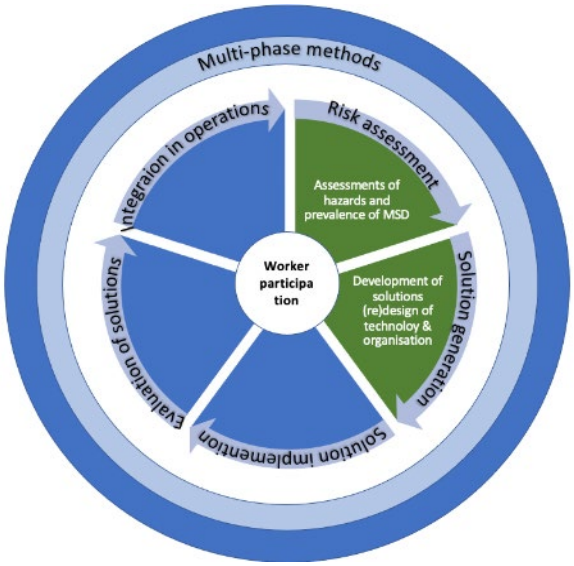
The company wished to implement changes to raise awareness about OSH and encourage workers to engage actively in identifying improvements to the workstations. The process included three steps:

1. Management and team leaders worked on ideas to address problems related to an ageing workforce and MSDs.
2. A number of workshops were established and workers were invited to participate in the design and implementation of the company's health and safety policies and practices. This included changes in workstation design, assembly and maintenance processes, introduction of active lunch areas, health training, leadership programme and peer support for on-the-job training.
3. Last, the implemented changes were assessed.

Participation: Direct participation. In total, 3,500 workers participated in the workshops.

Results: Following the intervention, the sickness rate decreased by 1%.

Method and approach:



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3.3.11 Redesign of a dyeing tub for fabric dyers

Sector: Textile industry (dyeing)

Main method: Discussion and testing of solutions

Key message:

Workers' participation in redesigning a conventional dyeing tub can be developed and implemented in practice, leading to reduction in workers' postural stress and discomfort.

MSE relevance:

The combination of methods does not require specific skills, additional expertise and/or resources for an MSE.

Level of Participation:

Problem identification has been done by an external specialist by observation, but workers participated in discussions to generate solutions and to develop implementation strategies.

Country: India

Organisation:

A small unit for dyeing of the sari worn by women in India. All the activities (design making, dyeing and rinsing) take place in the same area.

Participants: Around 200 workers (dyers).

Main health problem and hazards:

The dyeing process is a labour-intensive task, and workers adopt awkward postures over long periods of time, which results in severe discomfort in the low back, neck, shoulders and arms.

Main action:

Workers were involved through discussions (see section 2.3.5) in the redesign (see section 2.4.7) of the conventional dyeing tub, its implementation and evaluation.

Participation:

Before the testing phase, a new dyeing tub was developed based on input from workers. The design development stage itself comprised of three parallel processes:

- Observation of the work cycle, videotaping and discussions with the workers over a 6-month period in 18 different small-scale dyeing units.
- Interaction between the employers and the tub manufacturers.
- Testing of several prototypes (see section 2.4.8).

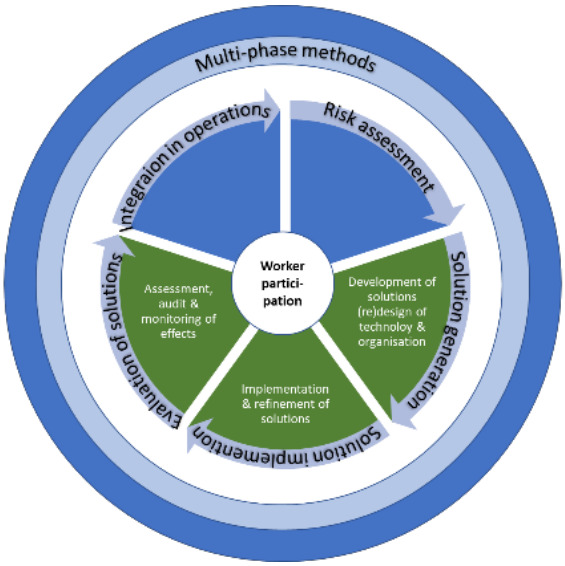
Altogether, three prototypes were developed and tested by the workers. The selected prototype was tested by nine workers for a period of three months. Similarly, the final version of the tub was tested in three units by nine workers. The final stage included assessing the changes in the production performance.

Results:

The involvement, trust and credibility generated by the participatory process facilitated the acceptance of the final design by dyers. The intervention showed a reduction in discomfort level of workers from 'severe' to 'moderate'.

Method and approach:

This is a multiple-phase method where workers participate in development, implementation of solution and evaluation phases.



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3.3.12 Workstation redesign to mitigate MSD risks at tablet computers

Sector: Manufacturing

Main method: Risk assessment and workstation redesign

Key message:

Redesign with worker involvement in the use of tablet computers reduces the risks of developing MSDs in the shoulders, arms and hands.

MSE relevance:

The methods and approaches used require external consultants. Especially, the ergonomic training requires specialists' skills and is time-consuming.

Level of Participation:

The workers were involved in the risk assessment, solution generation and implementation. However, the workers were guided by the researchers and did not have influence on the original direction of the intervention.

Country: Ireland

Organisation: Pharmaceutical plant.

Participants:

23 male pharmaceutical operators, 25-54 years of age, using tablet computers for at least 4 hours daily participated with an external consultant.

Main health problem and hazards:

Prolonged use of tablet computers leads to constrained hand and wrist postures causing MSDs in the shoulder, arm and hand. Further, when using a touch screen, the user is likely to hold their hand in a floating position above the screen to avoid accidentally touching the screen. The unsupported forearm position maintains muscle tension leading to MSDs.

Main action:

Participants received ergonomic training on postural risk assessment using RULA (Rapid Upper Limb Assessment), workstation setup and redesign (see section 2.3.7). The ergonomic training was divided into five 4-hour training sessions. Hereafter, the participants were included in the decision-making process of the workstation redesign (see section 2.4.7).

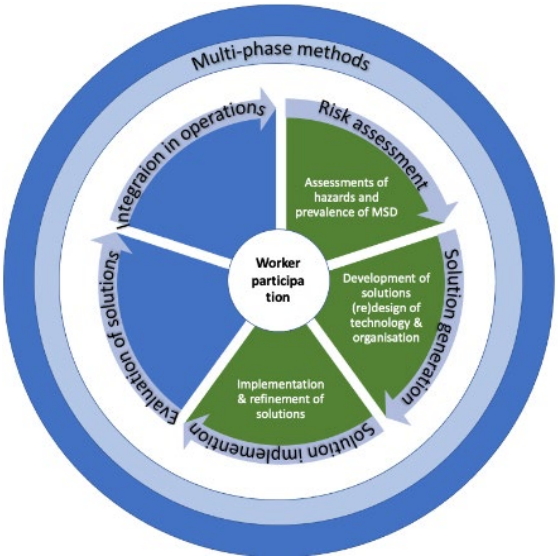
Participation:

All participants were involved in an evaluation of the self-reported feedback of the effectiveness of the participatory ergonomic approach and on physical and psychosocial symptoms. The feedback was obtained both pre- and post-intervention.

Results:

The tablet computers were positioned on an articulated flexible monitor arm that made it possible to adjust the device in height, tilt angle and distance. Furthermore, a standard keyboard and a two-button mouse were added. This enabled the participants to find their own optimum working setting. With the individually adjusted workstations, participants reported reduced neck and back as well as fewer wrist and hand injuries. Furthermore, the workers' involvement in the process also had a positive effect on psychosocial risk factors.

Method and approach:



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3.3.13 TILE - A risk assessment tool for manual handling

Sector: Manufacturing

Main method: Risk Assessment and implementation of solutions

Key message:

Risk assessments that focus on manual handling need to consider a variety of essential areas of activities to achieve sustainable safety and health improvements.

MSE relevance:

The relevance of the TILE-Risk Assessment for MSEs is high. The method can be applied without specialised equipment, and participants can conduct the risk assessment without the support of an external consultant.

Level of Participation:

The level of participation is moderate. Selected workers from different departments of the company were consulted both during the risk assessment and implementation of the measures.

Country: Ireland

Organisation:

A manufacturing company that produces various PVC products such as drainage, roofline and infrastructural duct products.

Participants:

To ensure an adequate level of expertise and technical competences, several stakeholders participated in a working group, including worker representatives, the production manager, the production and purchasing coordinator, senior supervisors, OSH advisor, and plant engineer.

Main health problem and hazards:

The main health problems were high risks of back injuries and MSDs due to manual lifting above shoulder height and below knee height, awkward postures when lifting away from the body, heavy loads (25 kg) and intense physical activity. The company had discovered a potentially problematic working routine during a review of all risks in the operations: Operators were manually lifting large bags of more than 25 kg from a storage location to a trolley, and subsequently lifted those from the trolley onto a weigh station.

Main action:

The working group conducted the risk assessment based on the TILE approach, which aims to help carry out a manual handling risk assessment. TILE is an acronym with each letter prompting consideration of essential areas of the activity. The acronym stands for the *Task* (identification of the manual handling activity that presents a risk), the *Individual* (identification of the persons carrying out the task and their physical capacities), the *Load* (what is being moved) and the *Environment* (where the object is being moved).

The working group assessed both workstations and the flow of operations. Based on the assessment, they proposed solutions. An external partner was engaged to supply new equipment to improve the workstations. The operators were trained in the use of the new equipment, and an updated risk assessment was carried out after the implementation process.

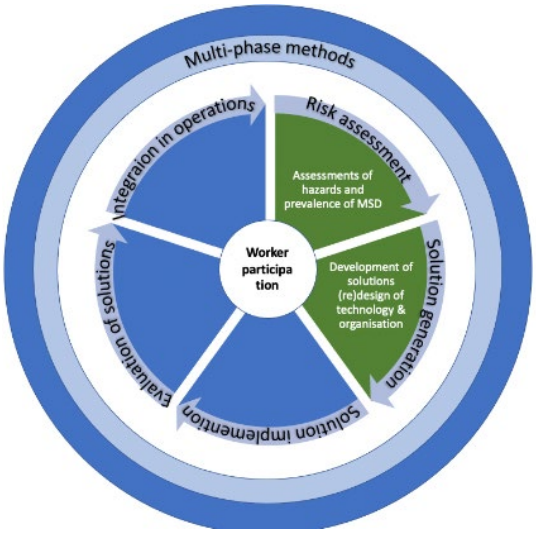
Participation:

Worker representatives were involved in the risk assessment, solution generation and implementation. To ensure a sufficient level of insight and knowledge, participants in the working group covered both the operations and management of the company.

Results:

Risk assessment based on the TILE approach led to a better understanding of the risk factors related to manual handling in the company. This led to the purchasing of a power vacuum lifter and a scissor lift table, both helping to lift the large bags. The new equipment reduced heavy lifting, repetitive movements and painful postures. The high level of cooperation between all stakeholders involved in the process led to a better understanding of the risk factors in the operations, and implementation of a solution that was acceptable for all.

Method and approach:



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3.3.14 Training in risk assessment in food industry

Sector: Manufacturing

Main method: Training and discussions

Key message:
Training of workers and section leaders in MSD risk assessment improves health and safety at work.

MSE relevance:

	Medium	

This method requires an external ergonomic consultant to teach workers about ergonomics and risk assessment.

Level of Participation:

Low		

Maintenance workers prioritised MSD risks and potential solutions based on what was suggested by section leaders.

Country: Italy

Organisation: Private company - industrial processing of wool

Participants:

45 maintenance workers and 11 section leaders participated. A project team, including the quality and health services of the company and two external ergonomic practitioners conducted the intervention.

Main health problem and hazards:

Work-related MSDs from handling heavy loads, application of heavy forces, and prolonged awkward postures.

Main action:

This method uses a combination of worker training in ergonomics (see section 2.3.7) and plenary discussions (see section 2.3.5) on MSD risk factors.

Participation:

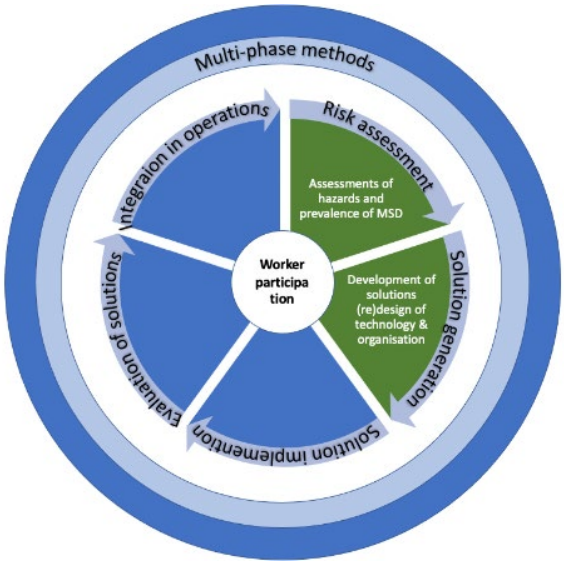
The workers participated in a 2-hour training module about MSD problems and ergonomics led by two external ergonomists. Section leaders received a 1-day training module. The ergonomists and the section leaders performed a risk assessment of the workplace using observations, videos, and interviews of workers, and then generated solutions. In a plenary session, the results of the risk assessment and the solutions were presented to the workers who were encouraged to provide feedback and suggest alternative solutions. The session lasted until agreement on the specified solutions and their priority was reached. The managers of the company verified the compatibility of the proposed solutions with the production.

Results:

The training increased the workers knowledge of good practices and included them in solution generation. Section leaders played a crucial part in the risk assessment and solution generation.

Method and approach:

This is a multi-phase method, as the section leaders were involved in the risk assessment and development of solutions. Workers were only included in the solution generation.



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3.3.15 Improving MSD prevention in automotive components

Sector: Manufacturing

Main method: Discussion

Key message:

Workers should participate in all stages of the prevention process. The participation of all stakeholders requires a high-level and constant effort to raise awareness about participation. In addition, it is important to consult the workers regularly to continue their participation.

MSE relevance:

This method focuses on changes that are easy to implement. It does not require training, specialised equipment or external consultants.

Level of Participation:

This method has a high level of participation, as workers perform a risk assessment of their own work tasks, and they identify and prioritise relevant solutions. In addition, there are no restrictions on the working areas, tasks targeted or activities developed.

Country: Portugal

Organisation:

The production area of a textile industry manufacturing components for the automotive industry. The manufacturing process requires the machines to work continuously 24 hours a day, seven days a week with 8-hour shifts.

Participants:

Operators who handle the machines. One operator from each of 8 work shifts joined a steering group and were directly involved in the development of solutions. In total, 19 operators participated in the implementation of the solutions.

Main health problem and hazards:

The operators mainly have MSDs in the neck, shoulders and lumbar spine caused by their postures and movements when they operate the machines.

Main action:

First, the operators answered a questionnaire to identify the risk factors of their work tasks. The steering group discussed (see section 2.3.5) the results and prioritised relevant solutions for implementation.

Participation:

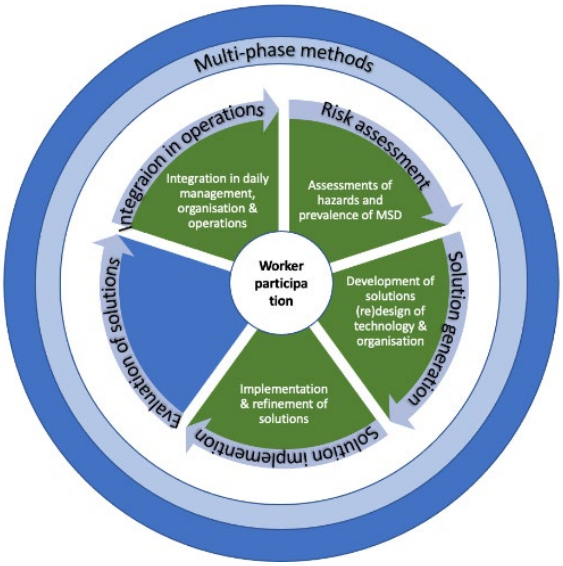
The steering group participated in three discussion sessions and developed the intervention strategy. In the first session, the steering group analysed the results from the questionnaires and produced a leaflet with information stating the risks. In the second session, the risk with corresponding tasks were organised in a table. In addition, the steering group discussed preventive measures. In the third session, the steering group evaluated, prioritised and selected solutions for practical implementation. All workers were involved in the implementation of the solutions.

Results:

Several technical solutions were decided upon, including acquisition of lifting aids, redesign of existing equipment to raise them to higher working heights, and mobile benches for seated work in low positions. The changes led to reduced discomfort and pain reported by the workers. Due to the success of the intervention, the managerial board decided to extend the same approach to all sections of the company.

Method and approach:

This method is a multi-phase method where the workers are involved in risk assessment, solution generation and implementation, and daily integration in operations.



References:

Fonseca, H., Santos, N., Loureiro, I., & Arezes, P. (2016). Participatory Ergonomic Approach for Workplace Improvements: A Case Study in an Industrial Plant. In: Arezes P. (Ed.) *Advances in Safety Management and Human Factors* (pp. 407-419). Springer. https://doi.org/10.1007/978-3-319-41929-9_38.

3.3.16 Validation of the ErgoPar method in manufacturing companies

Sector: Manufacturing

Main method:

ErgoPar participatory ergonomic method (see section 2.2.2), including worker representation on the (Ergo) work team, questionnaires and discussion circles.

Key message:

The ErgoPar participatory ergonomic method and similar methods allowed workers to use their knowledge of the work to identify where the problems lie and to generate solutions which can be discussed and decided upon in a systematic way.

MSE relevance:

This method has a medium relevance for MSEs. The approach is facilitated by an ErgoPar method specialist. This may be an external consultant or in-house staff member with in-depth knowledge of the ErgoPar method. Training in the ErgoPar method is offered by external organisations.

Level of Participation:

This method has a medium level of participation. It can be applied using both direct and indirect participation. Support from top management is crucial for commitment and for allocation of resources to the intervention. The preparation and capacity building of the Ergo Team is an important prerequisite of a successful ErgoPar intervention. Workers are involved through questionnaires and their representatives through an Ergo Team and during preventive circles.

Country: Spain

Organisations:

Five participating companies belonging to the chemical, food, ceramics, automotive and textile sectors, with the sizes of the organisations ranging from 40-300 workers.

Participants:

The number of participants varied across companies. Several production lines with 3-36 workers in each participated.

Main health problem and hazards:

The participating companies were experiencing a range of MSD health problems and hazards, including high rates of accidents due to overexertion, high rates of sickness absence due to MSDs, previously identified ergonomic hazards based on risk assessments, complaints by workers, and a general interest in improving working conditions in the companies.

Main action:

ErgoPar is a 3-step participatory approach that seeks to improve working conditions based on ergonomic principles. In the presented pilot cases, the areas of intervention were limited to one or two workstations or production lines in each company. A self-report questionnaire to workers was used to assess the prevalence of MSDs and identify risk factors. Priority risks were identified by an Ergo Team, and preventive measures were sought in preventive circles with the workers.

Participation:

- To begin the process, the management of the company and worker representatives formalise an agreement about the application of ErgoPar.
- Guided by the ErgoPar specialist, an Ergo Team is formed consisting of appointed or volunteer workers, and the team receives basic training in ergonomics and the ErgoPar methodology.
- The Ergo Team starts by evaluating questionnaire-based information on MSD-related hazards and exposures at the selected working lines.
- Next, the team organises preventive circles with direct participation of production line workers. The preventive circles consist of discussion groups guided by members of the Ergo Team that aim to reach an agreement on the causes of the risk factors identified in questionnaires.
- Together with the workers, the Ergo Team draws up a consensual proposal of preventive measures. Simple improvement measures are applied as soon as possible. As the first results are obtained in very short term, the involvement of all potential parties of the project is increased.
- Finally, the Ergo Team is responsible for monitoring the implementation and assessment of efficiency of the preventive measures. The companies' individual health and safety committees are urged to use this information to define a continuity strategy.

Results:

The ErgoPar method was successfully applied in five companies with positive results in four of them. The method allowed workers, who were already aware of the problems, to think about and generate solutions. For example, in a company that manufactures gels and colognes, there was a machine that packs colognes. The containers were placed manually, which involved awkward, repetitive movements because there was no room for a bottle positioner. The positioning of the three people working at the machine was complicated, and they had to work very fast as the conveyer belt could not be lengthened. The solution the workers came up with was to redesign the machine, allowing it to be put in a U-shape,

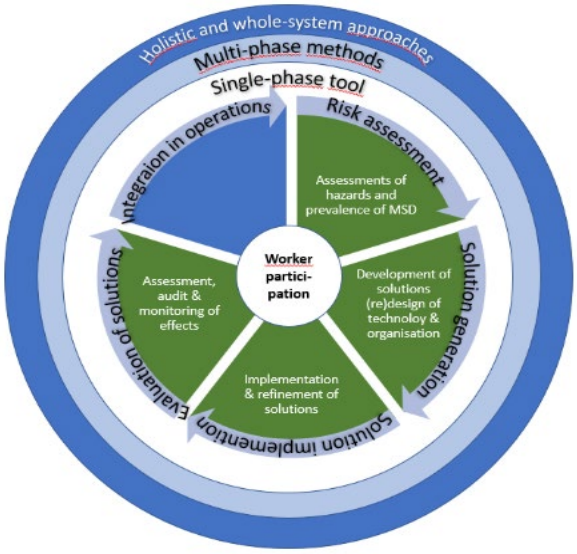
to lengthen the production belt, and to place a bottle positioner where the workers previously carried out the task manually.

In another example, workers in a chemical company identified the following solution: in labelling work, the distance of manual carrying was reduced by moving the boxes of labels to the side instead of leaving them on the shelves.

The method led to improved participation processes and communication channels among workers and their representatives, improved working conditions at an ergonomic level, and reduced levels of MSDs and associated costs. Most of the proposed measures related to tools and equipment (57%), followed by those related to the work process (31%), and those related to the layout of the workspace (13%).

Method and approach:

ErgoPar is a holistic participatory approach. The presented cases represent multiple phases including risk assessment, solution generation, implementation and evaluation, but not the integration in operations.



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3.4 Sector: Agriculture, Forestry and Fishing

3.4.1 Senior policy at a cemetery

Sector: Agriculture, Forestry and Fishing

Main method: Focus group interviews (see section 2.3.1) and discussions

Key message:

Careful preparation, dialogue, and inclusion of both younger and older workers in the discussion fostered better mutual understanding of roles and responsibilities. The design of the senior policy ensured that it fitted with company culture and identified those measures that were most relevant to workers.

MSE relevance:

This method has a high relevance for MSEs. The intervention requires assistance from an external consultant, but is relatively low-cost and requires no prior training.

Level of Participation:

This method has a medium level of participation. All workers had the opportunity to contribute to focus group interviews, complete a questionnaire on aspects of the working environment, and give input. Four worker representatives and the manager developed the senior policy.

Country: Denmark

Organisations:

Roskilde Kirkegaarde (cemeteries) and Danish Centre for Development and Quality Management (SCKK)

Participants:

Staff, primarily gardeners and administrative personnel, at three cemeteries and one crematorium and their manager. A consultant from the Danish Centre for Development and Quality Management (SCKK) supported the process.

Main health problem and hazards:

As the workforce ages, the company aims to retain experienced workers by improving the physical and psychosocial work environment, including prevention of MSDs. Older workers, with their knowledge and experience, are a valuable resource that should be retained for as long as possible. There was a need for a senior policy that aimed at increasing job satisfaction for all workers by improving the physical and psychological work environment.

Main action:

Based on the findings from focus group interviews and questionnaire responses from workers, a working group of four worker representatives (one from each of the four small cemeteries) and the manager of Roskilde Cemeteries developed a senior policy. They were supported by an external consultant, hired with financial support from the Danish Centre for Development and Quality Management (SCKK).

Participation:

The consultant carried out two-hour focus groups with younger workers (30-40 years) and older workers (45-60) from each cemetery. The younger participants discussed how they experienced working together with older colleagues, and the older group discussed the impact of their age on their work in the cemetery and how working conditions could be improved. Following these focus groups, the consultant interviewed the managers from each cemetery, gaining their perspective on the issues raised by the workers. From the interviews and focus groups, the external consultant identified cross-cutting

topics. The workers and managers then verified these topics to make sure they were an accurate representation of what had been said.

All workers were asked to complete a questionnaire on the aspects of their work environment that would help them to consider staying at work after the age of 60: namely, flexible working hours, their own influence on workplace decisions, adaptive work pace, changes in the current composition of work tasks, reduced working hours, further training and the psychosocial work environment.

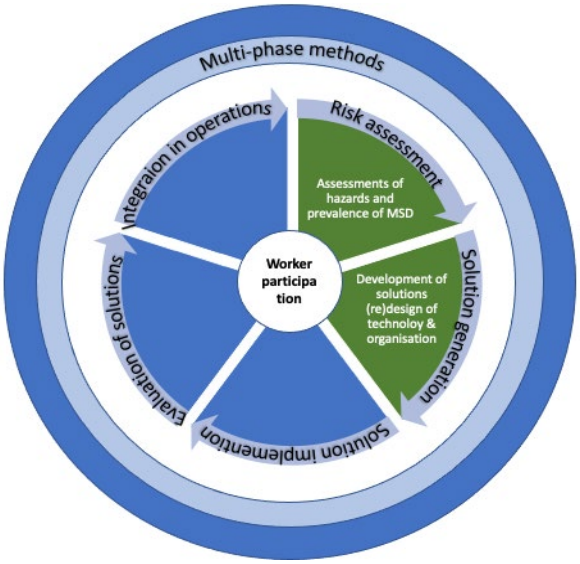
The working group used findings from the two processes to draft the senior policy. The policy was created in line with company culture and integrated into general personnel policy. In addition, the working group created a roll-out schedule, including approval of the senior policy by the board of the cemetery, as well as a special launch to communicate the policy to workers

Results:

The senior policy has been in place since May 2007. The policy defines 'senior' workers, includes a general component for all workers over the age of 45, and specifies options for individual agreements between workers and the workplace.

Method and approach:

This is a multi-phase method. The cemetery workers identified potentially problematic psychosocial risk factors and physically strenuous work tasks. Based on the input, the working group drafted the senior policy. The approach recognised that both MSDs and psychosocial risk factors need to be looked at together.



References:

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3.4.2 Reduction of pain for office workers

Sector: Administrative and support service activities

Main method:

Risk assessment checklist (see section 2.4.3) and the use of questions focused on *who*, *where*, *when* and *how* to discuss solutions and their implementation.

Key message:

Two rounds of risk assessments, one unsupported and one guided by ergonomists, reduce MSDs in office workers.

MSE relevance:

This method has a high relevance for MSEs, as it is low-cost, does not require specialised equipment and is easy to implement. However, facilitation is needed in the second stage, when the solutions and how to implement them are discussed and decided upon.

Level of Participation:

This method has a high level of participation. In the presented example, workers were trained to conduct the risk assessments.

Country: Turkey

Organisation: Municipality

Participants: 58 municipal office workers using computers.

Main health problem and hazards:

Office workers suffered from MSDs in the neck, shoulder, arms and hands.

Main action:

Researchers trained the workers in ergonomic principles, risk assessment, MSDs, exercises and relaxation techniques (see section 2.3.7). Two rounds of risk assessments and solution implementation were performed. First by the workers individually, and second, by the workers under guidance of the researchers. Researchers made monthly visits to increase the sustainability of the changes.

Participation:

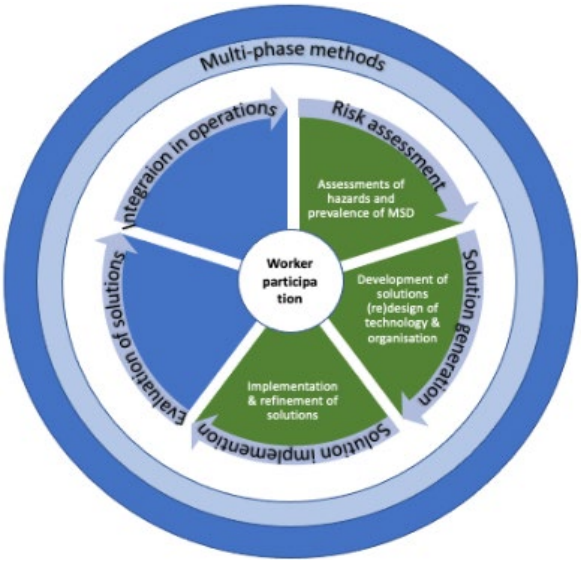
In the first stage, the participants took part in a 2-hour training session. Here, they developed basic skills in office ergonomics and individual risk assessment. In the second stage, the researchers visited the participants at work. During these visits, the participants used a checklist developed by the researchers to identify hazards and assess risk. In addition, they had to suggest solutions to those risks. The researchers and the participants together decided on how to implement these solutions. The participants were asked the questions *who*, *where*, *when* and *how* when they had to implement each solution.

Results:

The method led to reduced pain in the neck and upper extremities, and lower levels of disability. The participants mentioned that the monthly visit from the researchers contributed to a continued efficacy of the implemented solutions.

Method and approach:

This is a multi-phase method as the participants were involved in risk assessment, solution generation and solution implementation.



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3.5 Sector: Administration

3.5.1 Health ambassadors to increase physical activity

Sector: Public administration

Main method:

Training of health ambassadors in planning and performing physical activity with co-workers.

Key message:

Health ambassadors receiving a two-day training course in planning and conducting physical activity with co-workers are effective in reducing MSDs and increasing social wellbeing of co-workers.

MSE relevance:

Health ambassadors can function in all sectors, types and sizes of companies.

Level of Participation:

The level of participation is considered high due to a strong involvement of both health ambassadors and workers in solution generation and implementation.

Country: Denmark

Organisation:

The administrative section of the Northern Administrative Region of Denmark (a public sector organisation including predominantly administrative and healthcare personnel). The administrative section includes approximately 600 workers.

Participants:

Administrative personnel and computer operators. Among the staff, twenty workers either volunteered or were appointed by co-workers or managers to become health ambassadors.

Main health problem and hazards:

Workers suffered from musculoskeletal pain, especially neck and shoulder pain due to sedentary computer work. As well as good ergonomics, workplaces need to facilitate more activity and movement among workers to tackle the health effects of sedentary work.

Main action:

Training of worker representatives as health ambassadors to plan and conduct physical activities with co-workers (see section 2.4.8).

Participation:

The worker representatives underwent a two-day training course provided by the Danish Association for Company Sport (*Dansk Firmaidræt*). The main focus of the course was to provide ideas and inspiration for physical activity that can be performed by office workers during working hours.

Within their respective work teams, the health ambassadors first initiated meetings with co-workers to introduce the health ambassadors' roles and match expectations of activities; to brainstorm ideas for activities; and to identify co-workers with specific knowledge or previous experience of physical activity (that is, a worker who could act as a volunteer yoga instructor or someone knowledgeable about fitness and strength exercise) and the willingness to engage their team in the specific activity.

The health ambassadors, together with the co-workers and team managers, then decided on activities that best matched the office space and outdoor surroundings as well as their frequency and duration, and which had a strong focus on social elements. The activities included joint strength exercises using elastic rubber bands during weekly staff meetings or at another fixed time, weekly walks, physically active breaks, walk-and-talk-meetings, yoga and other types of exercises as regular or one-time events.

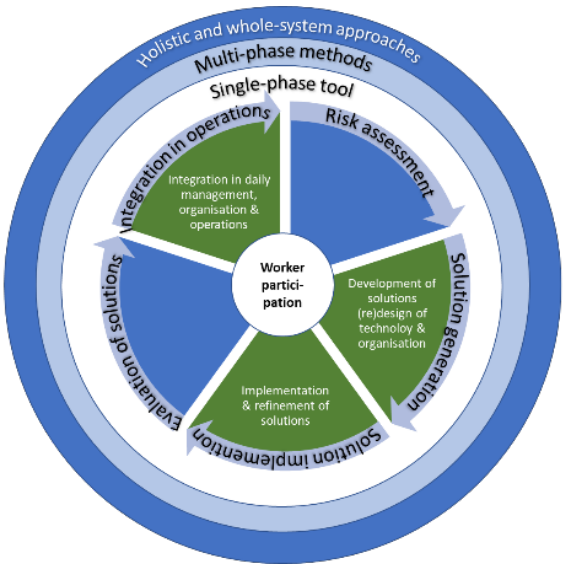
Results

The health ambassadors succeeded in engaging the majority of their co-workers in physical activity, and raising awareness of the mental, physical and social benefits of doing physical activities. The co-workers reported reduced MSDs, increased wellbeing, and a high degree of social benefits such as team coherence, communication, social wellbeing and a positive work culture.

The health ambassadors arranged their own physical activity events (such as an imaginary walking road trip to Barcelona), or signed the team up for local sporting events (such as a regional company 5-kilometer relay competition/social event) or initiatives (like the yearly, national, 1-month 'bike to work' competition). In addition, some health ambassadors used nudging in the form of posters placed at strategically important places to encourage physical activity, like posters encouraging workers to take the stair rather than the elevator. The health ambassadors used each other for inspiration and sharing of ideas and initiatives.

Method and approach:

This is a multi-phase method. The health ambassadors initiate solution generation and are responsible for the implementation and integration of physical activity.



References:

Personal correspondence with the organisation.

3.6 Sector: Other service activities

3.6.1 Identification tags for cleaning and supplying workwear

Sector: Other service activities / cleaning and laundry service

Main method: Implementation through discussion

Key message:

Engaging workers in the implementation of a new operational system to decrease manual handling of loads ensured that the implementation went smoothly, and that workers were satisfied with the system and the process.

MSE relevance:

Medium

An occupational health advisor (or similar) is needed to facilitate the process and assist with the implementation. Some financial resources for the intervention and the training of workers is needed.

Level of Participation:

Medium

Workers participated in all phases of the process from the pilot phase of the project (solution generation) to implementation strategies.

Country: Slovenia

Organisation: University Medical Centre in Ljubljana

Participants:

The University Clinical Centre in Ljubljana has a laundry care service that currently has 21 female employees. In addition, approximately 75 employees from individual clinics who were trained to operate the system of issuing workwear also participated. All were women 25-63 years of age. The workwear tracking system was introduced at 17 locations where daily workwear is issued.

Main health problem and hazards:

The process of manually sorting dirty workwear is time-consuming, ergonomically burdensome, unhygienic and economically inefficient. Laundry workers are especially prone to back pain because of prolonged forward bending and manual handling of heavy loads.

Main action:

To improve the working conditions of laundry workers and the distributors of workwear, the university decided to implement a track and trace system for the workwear. The system consisted of attaching non-contact, long distance, waterproof, high temperature resistant, data storage, automatic identification tags (radio frequency identification, RFID) to the workwear. The system is operated through a mobile phone application. Workers participated in development, implementation and evaluation of solutions through discussions (see section 2.3.5).

Participation:

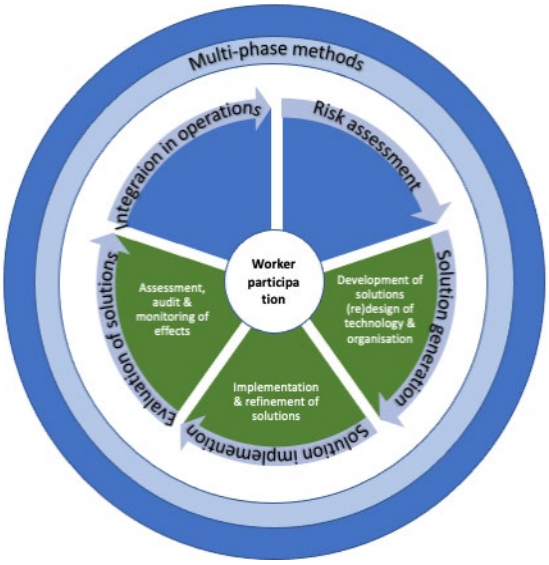
Workers were involved in the project in all stages of the implementation. In preparation for the implementation, workers' suggestions and opinions were obtained. In the pilot part of the project, two workers were selected from the personnel and trained to operate the application. Once fully trained, the two workers became mentors to the other workers, especially to all new workers. All workers participated in discussion and received training (see section 2.3.7).

Results:

Four years after the implementation of the workwear tracking system, workers are very satisfied with the RFID application. They are relieved of the manual counting of clean and dirty workwear, have immediately accessible data, transparency and no complications with customers. Older workers, who were not adept at working with computers, were proud to have learned to operate the application.

Method and approach:

Workers participated in solution development and implementation as well as in evaluation of solutions.



References:

Personal correspondence with the Slovenian focal point contact and the University Clinical Centre in Ljubljana (Occupational Safety and Health Service).

3.6.2 Job rotation to reduce biomechanical exposure improve team work-

Sector: Other service activities

Main method:

Trade union consultation, worker questionnaires, worker testing of the new work system and evaluation focus groups (see section 2.3.1).

Key message: Unions and researchers may be partners in preventive projects and systematic evaluations. Union involvement ensures representative worker participation, but not necessarily individual worker participation. Job rotation can be a useful measure to help reduce exposure to harmful movements, but to work successfully it needs to be discussed with and agreed on by workers.

MSE relevance:

The method is of medium relevance for MSEs, as it requires an external consultant, OHS professional or another external intermediary.

Level of Participation:

The level of direct worker participation is low to medium. The workers had a voice throughout the study, but no or limited input in decisions concerning content, target areas or activities. However, the workers were involved in testing and evaluation. There was also effective representative participation through the trade union.

Country: Sweden

Organisation: Berendsen: Swedish laundromat

Participants: Researchers, management, union representatives and workers. In total, 55 workers with 13 different language backgrounds participated.

Main health problem and hazards:

The work performed at the laundromat is repetitive and particularly demanding on the neck, shoulders, arms, wrists and back. Previously, employees mostly worked individually with repetitive tasks, which increased the risk of workload problems.

Main action:

The introduction of job rotation to modify exposure to MSD risk factors. The intervention also included language lessons to help the integration of the workers from other countries.

Participation:

The project stemmed from a concern of both the trade union and employers over the rate of musculoskeletal complaints among their workers who perform monotonous repetitive work. In collaboration, researchers, management, union representatives and workers developed a job rotation intervention. The study utilised pre- and post-intervention measurements to assess the extent of changes related to job rotation. The employees tested the new job rotation for a few months (see section 2.4.8). Evaluation of the intervention entails focus group discussions shortly after and six months after implementation, along with a questionnaire and methods to quantify biomechanical and physiological exposures as used at the pre-intervention stage. The study primarily uses indirect participation through worker representatives.

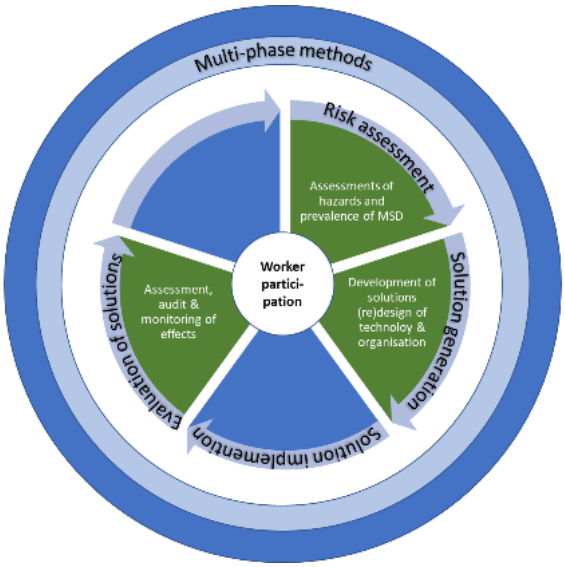
Results:

Work rotation led to better health and wellbeing in the laundry in Ockelbo. It also provided workers with greater variety in their work and improved team spirit. All newcomers are now trained to do several

different tasks. A prerequisite for the successful result is good collaboration between employers and workers and very committed union representatives.

Method and approach:

Workers' musculoskeletal complaints directed the planning of the study and systematic pre- and post-evaluation at various levels ensured documentation of the intervention's efficiency.



References:

Sällberg, A. *Forskningssamarbete med tvätteri bidrar till integration och bättre arbetshälsa - Högskolan i Gävle* (n.d.). Retrieved 6 July 2021, from https://www.hig.se/Ext/Sv/Arkiv/Externa-nyheter/2020-05-26-Forskningssamarbete-med-tvatteri-bidrar-till-integration-och-battre-arbetshalsa.html?fbclid=IwAR3fpSSBtplm1KsNnBRK0oWUuS2duj0ghyf2a2jCYE0I6YnlTDFpfIro8-o

Audio link to a series of interviews from Sweden's national radio (Sveriges Radio P4, in Swedish):

Groop, T. (Producer). (24 November 2020). *Arbetsrotation ger bättre hälsa och gemenskap på tvätten i Ockelbo* [Audio podcast]. Retrieved 6 July 2021, from https://sverigesradio.se/artikel/7606213?fbclid=IwAR1Dg9s-8VGp38o24TlZBfeESAJ_Ss2Rn4KIb1rwjMW_ySxNjWV7Kq_mbFc

Strömberg, A. (n.d.). *Forskning pågår 2021: Akademin för hälsa och arbetsliv*. Available from: https://www.diva-portal.org/smash/get/diva2:1533089/FULLTEXT01.pdf

3.7 Sector: Education

3.7.1 Prevention of MSD risk the educational leisure sector

Sector: Education / educational leisure sector and sociocultural animation

Main method:

Questionnaires, individual and group interviews, observations and working groups (using the ErgoPar participatory method).

Key message:

The participatory techniques facilitated the collection of useful, reliable and valid information about the working conditions of the groups involved. It shows how trade unions can use the same participatory methods to accurately analyse work situations.

MSE relevance:

The methods were all used with workers from SMEs, and the study was carried out by trade union researchers. The resulting guide that describes what was done and the diagnostics of the different jobs and tasks provides advice on how the results can be used in individual workplaces.

Level of Participation:

The participants took part in two phases and partly predefined content.

Country: Spain

Organisation:

36 different organisations providing activities outside of formal education participated in the study. These included organisations that provide extracurricular activities within schools, out-of-school education, at summer camps and activities run by civic centres.

Participants:

Workers, primarily women with an average age of 33, from 36 different SMEs with a range of fewer than 50 workers to a maximum of 251 workers.

Main health problem and hazards: Workers suffered from low back, neck, and shoulder pain.

Main action:

This was a participative study by a trade union to determine risks and provide guidance on prevention measures in the informal education sector. It was done in the context of a national labour agreement covering the sector. It involved assessment of hazards and prevalence of MSDs through questionnaires, observations, individual and group interviews, and working groups that focused on preventive circles to redesign work tasks.

Participation:

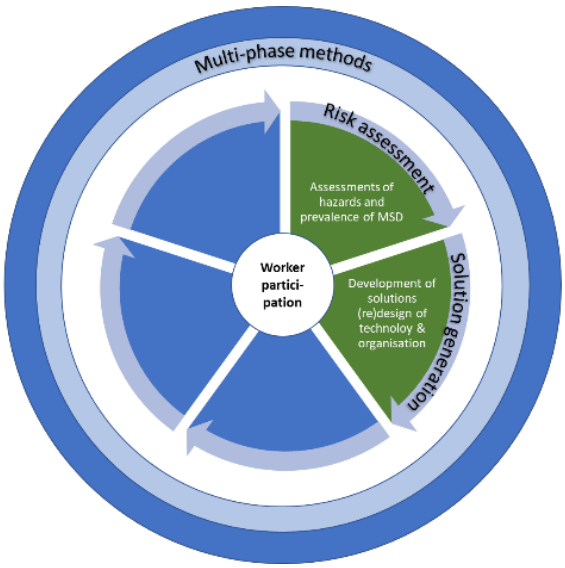
Workers and companies collaborated in the application of various participatory tools such as completion of risk assessments using questionnaires, development of individual and group interviews, facilitation of observation, as well as the development of preventive circles (working groups with workers). These collaborations allowed the identification of MSDs, risk factors, their underlying causes, and preventive measures.

Results:

The participatory techniques fostered collection of useful, reliable and trustworthy information about working conditions and subsequently elaboration of effective and efficient preventive proposals targeting MSDs. The presented study also identified a general a lack of awareness and/or information regarding occupational health, ergonomic risks and MSD prevention. The results can be used by other similar workplaces to look for their own prevention measures.

Method and approach:

Risk assessment and solution generation were addressed using various tools at different points in the study including questionnaires, interviews and group work.



References:

Larripa Feliz, L., Sevilla Zapater, M.J., García Heras, Y., Ortiz Barragán, P. (2015) *Estudio diagnóstico preventivo y buenas prácticas ergo-nómicas en el sector de ocio educativo y animación sociocultural.* Retrieved 6 July 2021, from https://www.ccoo.es/0652d0d06d04e8f7c73504ff9bccbb31000063.pdf

Serrano García, J., García Heras, Y., Ortiz Barragán, P., Sevilla Zapater, M.J., López Bermúdez, L. & Morán Barrero, M. P. (2012). *Estudio diagnóstico sobre riesgos ergonómicos y trastornos asociados*. Retrieved 6 July 2021, from https://fe.pv.ccoo.es/74971c0c5e353826f85cb7eb3796f4fa000063.pdf

3.8 Sector: Accommodation and food service activities

3.8.1 Designing hotel rooms with cleaning in mind

Sector: Accommodation and food service activities / hotel

Main method: Assessment of solutions

Key message:

Before the construction phase of a full renovation of a hotel was initiated, workers tested and provided feedback on three model hotel rooms to identify potential MSD risks.

MSE relevance:

The method has a low relevance for MSEs, as designing three model rooms is costly.

Level of Participation:

This method has a medium level of participation, as the workers only participated in the generation of solution phase.

Country: France

Organisation: 4-star hotel and CRAMIF (Regional Health Insurance Fund for Ile de France region).

Participants: Hotel cleaning staff

Main health problem and hazards: MSD risks during hotel room cleaning

Main action:

As part of a total refurbishment project, the hotel management hired an architect to design three model rooms. Cleaning staff tested the rooms and provided feedback on the layout of the room and potential workplace hazards in relation to cleaning the rooms. The cleaning staff found the model rooms to be broadly representative of the work situations found in the hotel. Following the tests, analysis of the feedback helped identify important workplace hazards (see section 2.4.8).

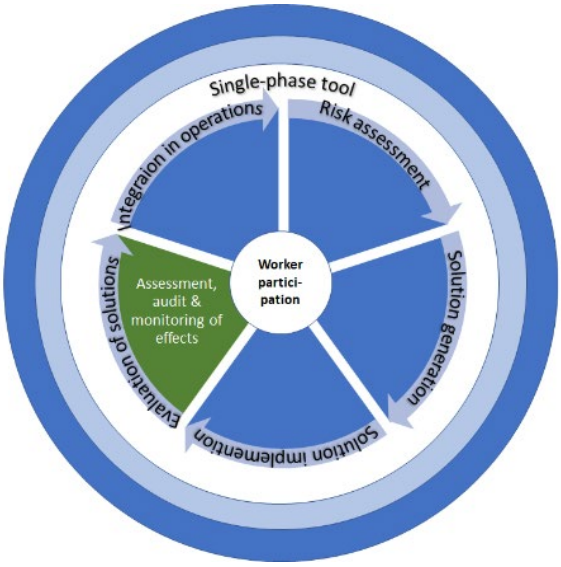
Participation: The cleaning staff tested the model rooms and provided feedback.

Results:

The design and layout of the new hotel rooms were finalised based on feedback of the cleaning staff during the tests. Involving the cleaning staff in the project and preparing them for the upcoming changes in the workspace was invaluable in gaining acceptance of the new working conditions.

Method and approach:

This is a single-phase method for evaluation of solutions, as cleaning staff were consulted to test model rooms.



References:

EU-OSHA (2009). *Preventing harm to cleaning workers.* Retrieved 6 July 2021, from https://osha.europa.eu/en/publications/reports/TEWE09006ENC/view

3.9 Sector: Wholesale and retail trade

3.9.1 Prevention of low back pain – redesign of an industrial assembly line

Sector: Wholesale and retail trade / repair of motor vehicles and motorcycles

Main method:

The method included a steering group with worker safety representatives, production workers who were included in the design team, and worker interviews.

Key message:

Involvement of worker safety representatives in steering the intervention, and production workers in the design team, combined with measures such as interviews and observation of all workers enabled the redesign of workstations and other measures to effectively reduce exposure to work-related physical and psychosocial risk factors of low back pain.

MSE relevance:

The method has medium relevance for MSEs due to the costs of redesigning workstations and involving an external consultant.

Level of Participation:

Indirect participation through worker representatives ensured participation of workers in risk assessment and solution generation. The process was initiated and overseen by a steering committee of management and worker safety representatives.

Country: Brazil

Organisation:

A mid-sized (approximately 500 workers) catalogue and e-commerce retail company in Blumenau, southern Brazil.

Participants:

Participants included assembly line workers, worker safety representatives, production and maintenance workers and an external ergonomic consultant.

Main health problem and hazards:

Workers suffered from low back pain due to heavy physical work, bending and twisting, manual handling of objects or people, and whole-body vibrations.

Main action:

A 5-step participatory approach was used. The workers, ergonomist, management and technical personnel collaborated in groups to identify problems, develop and evaluate solutions and implement changes.

Participation:

The participatory process consisted of five steps: preparation, workplace analysis, solution generation, solution implementation and evaluation. During the preparation step, top management appointed representatives from management, human resources, and health and safety to a steering committee. Next, the steering committee directed the formation of an analysis and design team, which included production supervisors, production and maintenance workers, and an ergonomist.

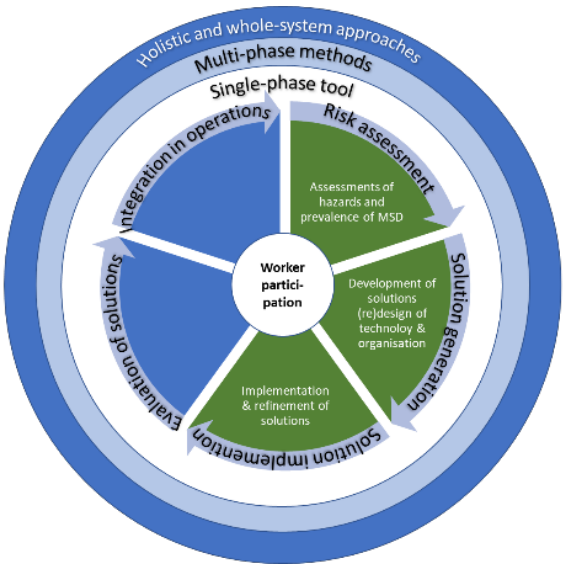
Based on information attained from worker interviews about MSDs and work tasks, and observations of workers, the analysis and design committee discussed and prioritised the two most frequent and serious risk factors of low back pain. Next, they brainstormed solutions, which were subsequently discussed with the steering committee taking into account the relative advantage, costs, compatibility and complexity of solutions. Finally, solutions were implemented

Results:

The analysis and design team identified repetitive manual material handling in awkward postures (excessive reaching, bending and twisting) related to configuration of the assembly line in the boxing and dispatch departments and low job control as the two most important risk factors. The assembly line's layout was redesigned (see section 2.4.7), which eliminated two manual material-handling tasks, and allowed for higher levels of job control. Further, workers were trained to enable job rotation and/or relocation to different tasks.

Method and approach:

This is a multi-phase method. Indirect participation was used to assess risks, and generate and implement solutions.



References:

Bernardes, J. M. J. M., Wanderck, C., Moro, A. R. P., Renato, A., & Moro, P. (2012). Participatory ergonomic intervention for prevention of low back pain: assembly line redesign case. *Work*, *41*(Supplement 1), 5993-5998. https://doi.org/https://dx.doi.org/10.3233/WOR-2012-1000-5993

3.9.2 The healthy workplace participatory programme in a retail setting

Sector:

Wholesale and retail trade: regional grocery store chains

Main method:

Healthy Workplace Participatory Programme (HWPP, see section 2.2.1). This included work groups, workplace mapping activities by workers and worker surveys.

Key message:

Sufficient worker and facilitator time are needed if methods such as these are to succeed. There needs to be sufficient skills among team members and training if necessary. Therefore, resources as well as commitment to the process are essential. Effective communication of actions to all workers is also key. While this method focuses on workplace health promotion, the same methodology could be used for OSH risk prevention.

MSE relevance:

Low		

Organising and conducting initial meetings, in-depth interviews, co-development, and train-the-trainer activities require assistance from external experts and can be time-consuming and expensive for MSE's.

Level of Participation:

The level of participation is high due to a strong involvement of both workers and management from the project's early design to implementation of solutions with workers having a strong voice throughout the entire process.

Country: USA

Organisation:

Grocery store chain with a large, busy store located in a demographically diverse neighbourhood.

Participants:

159 grocery store workers; 6 frontline workers with racial and gender diversity were engaged in the design team and 19 participated in focus groups (see section 2.3.1).

Main health problem and hazards:

Poor health status, including musculoskeletal complaints due to inadequate health behaviours among low-wage workers.

Main action:

A design team and steering committee were used to determine workplace health promotion interventions. Additionally, the research team conducted surveys with 120 workers and 19 participants in focus groups to gather information about current health status, behaviours and health beliefs of store workers, as well as information about existing workplace health support.

Participation:

The HWPP model included a design team made up of volunteer frontline workers and a steering committee comprised of multiple management levels and trade union representatives. These two teams worked together, with the help of a programme facilitator, to create health and wellness activities for their workplace. The model used the Intervention Design and Analysis Scorecard (IDEAS tool) which includes seven steps: 1) identify problems and contributing factors, 2) develop intervention objectives and activities, 3) set selection criteria, 4) apply selection criteria, 5A) rate intervention activities, 5B) select intervention activities, 6) plan and implement intervention activities, and 7) monitor and evaluate intervention activities. With the guidance of the facilitator, the design team works through these steps using worksheets to create intervention options (steps 1-5A) to present to the steering committee (step 5B); both teams work together to implement and monitor the intervention activities (steps 6-7).

The design team's main role was to complete the IDEAS tool worksheets, creating intervention options relevant to their work environment to present to the steering committee for consideration. After the steering committee's approval, the design team worked together with the steering committee to finalise and implement intervention activities. While the majority of the programme was designed to take place during team meetings, design team members had to complete 'homework' tasks between meetings in order to increase productivity during meeting time; these homework tasks took approximately 30-60 minutes to complete each week. The also used brainstorming to generate ideas.

Different participatory measures were used, including a survey, data collected from focus groups, a store mapping activity in which the design team drew their store layout and mapped their routes throughout the workday while noting their perceptions of the positive, neutral and negative impacts on their health.

In total, seven 1-hour meetings over the course of nine weeks were held, with two optional meetings scheduled if needed to complete steps 1-5A of the IDEAS Tool.

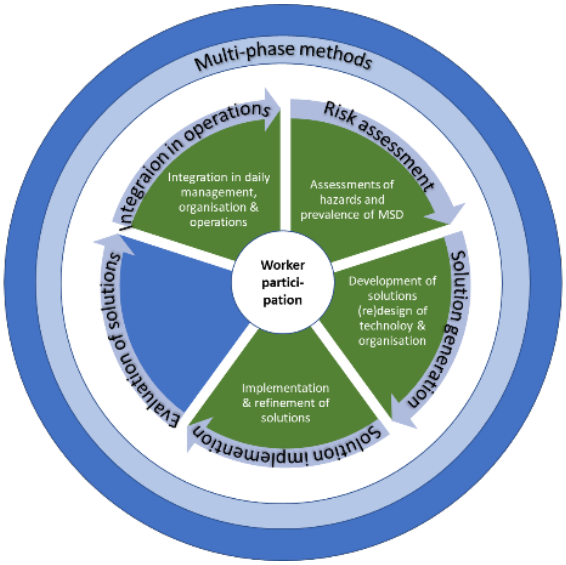
Results:

Examples of implemented actions were a new employee refrigerator and price-discounted bottles of water in the restroom. Once implemented, not all workers were aware of the actions and they indicated that direct communication from store management about the actions may be more useful than printed materials placed throughout the store.

Participatory programmes such as the HWPP show promise as a methodology for creating effective Total Worker Health interventions. This approach is useful for developing activities that can be used by workers and are relevant to their health. This is particularly important for workers in lower-paying jobs or in jobs that have complex or chaotic work environments, which present other challenges for good health behaviours.

Method and approach:

Multiple phases were addressed using various tools at different points including collaborative meetings, surveys, interviews, ergonomic training and development of online resources.



References:

The National Institute for Occupational Safety and Health (NIOSH), US. *NIOSH Total Worker Health® Program.* Retrieved 6 July 2021, from https://www.cdc.gov/niosh/twh/

Strickland, J. R., Kinghorn, A. M., Evanoff, B. A., & Dale, A. M. (2019). Implementation of the healthy workplace participatory programme in a retail setting: A feasibility study and framework for evaluation. *International Journal of Environmental Research and Public Health*, *16*(4). https://doi.org/10.3390/ijerph16040590

3.10 Sector: Transportation and storage

3.10.1 Involving drivers in risk assessment and action plans

Sector: Transportation and storage

Main method: Application of the SOBANE method for risk assessment and solution generation (see section 2.2.3)

Key message:

Direct participation of workers using SOBANE (screening, observation, analysis, expertise) helps to strengthen workers self-confidence and engagement in the participatory process.

MSE relevance:

The first two steps of the method are easy to organise and implement in MSEs. Several resources are available in French. The method may require specialists in the levels 'analysis' and 'expertise'. In this case, a prevention advisor facilitated the implementation of the method.

Level of Participation:

Problem identification and solution generation are made by workers.

Country: Belgium

Organisation: A small company with 58 workers specialised in the distribution of newspapers and magazines.

Participants: Ageing workforce (average age of 49 years) with a driver-delivery function

Main health problem and hazards: Back pain and sick leave related to handling packages and an ageing workforce.

Main action:

An ergonomist initiated the implementation of the SOBANE method to decrease the risk of MSD problems.

Participation:

Participatory screening of the risks was carried out during a meeting. Five people participated: the prevention coordinator (who is also a spare driver), three drivers and the prevention advisor. A document explaining the method and the objectives was distributed before the meeting to all workers.

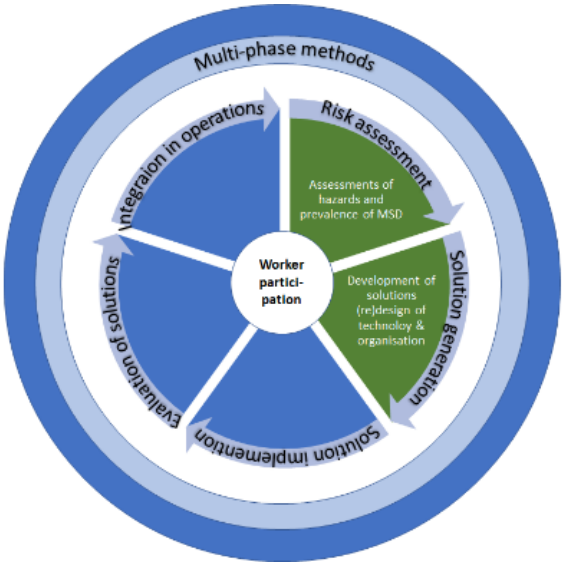
A systematic review of the work situation was carried out together with the participants. When a problem was identified, participants searched for immediate practical prevention measures. For some points, a more in-depth analysis was conducted afterwards.

The prevention advisor observed the work situation based on the first meeting's identification of the most critical situations regarding MSDs. The participants met for a second time to analyse observation results. The meeting focused on the aspects that can cause MSDs. Participants tried to determine the immediate technical measures that could be taken to reduce this risk. Two elements required further analysis by an ergonomist during the third level of the SOBANE strategy. The result was an action plan presented and discussed with all workers by the business unit. The focus of the discussion was to evaluate the feasibility of each item and plan their implementation. The participation of the workers in the implementation of the solutions and their evaluation is not described in the case.

Results: The concrete implementation of the first proposals had enhanced the worker's self-confidence and their engagement in preventive activities.

Method and approach:

Although SOBANE method is a multi-phase method, the case describes worker participation during risk assessment and solution generation.



References:

Direction générale humanisation du travail (2007). *Serie strategie SOBANE gestion des risques professionnels: Troubles Musculosquelettiques*. Retrieved 6 July 2021, from https://emploi.belgique.be/sites/default/files/content/publications/FR/ae4354fd3ee840d2ab4cc19561d946d63.pdf

The example was provided by the authors of the reference through personal communication.

3.11 Sector: Transportation and storage

3.11.1 Interventions to reduce the risk of MSDs in business drivers

Sector: Transportation and storage / transport industry

Main method:

The method includes initial meetings with organisations, questionnaires to selected workers, in-depth interviews, co-development of intervention activities and train-the-trainer.

Key message:

Raising awareness of the risks of MSDs in drivers who work from their vehicles is important. The participatory process was successful in affecting change at management level.

MSE relevance:

Organising and conducting initial meetings, in-depth interviews, co-development, and train-the-trainer activities require assistance from external experts and sufficient time and resources.

Level of Participation:

The level of participation is considered high due to a strong involvement of both workers and management from the project's early design to implementation of solutions with workers having a strong voice throughout the entire process.

Country: United Kingdom

Organisation:

This was a research intervention that recruited four organisations with professional drivers who drive more than 24,000 km/year or minimum 4 hours/day: a multinational manufacturing company, a UK-based utilities organisation, a multinational pharmaceutical company, and a multinational consultancy. They were large organisations, employing over 500 workers.

Participants:

Long-distance professional drivers and their managers, and a champion from each organisation (see section 2.4.8) who had some knowledge of the work-related MSD issues and the drivers' work. An important part was working with senior managers.

Main health problem and hazards:

Low back, neck and shoulder pain due to long-distance driving, working from a vehicle, and manual handling. The aim was to work with drivers and their managers to co-develop intervention activities to raise awareness of musculoskeletal health in drivers, including use of the car as a mobile office and manual handling from the car

Main action:

Indirect participation through training of workers who had responsibility for training in ergonomic principles (see section 2.3.7) and direct participatory development of online resources. The senior representatives agreed upon implementing 'train-the-trainer' sessions, in which the research team provided training to those responsible for training provision of professional drivers in the individual organisations (managers, occupational health managers, health and safety officers, and professional drivers). These train-the-trainer sessions provided general information on driving ergonomics and organisational-specific information, such as sources of help within individual organisations. With support from the research team (as necessary), the trained personnel were then expected to disseminate their knowledge in their respective organisations. Further, the participation also led to the development of an online resource to aid dissemination and to provide guidance to business drivers and their employers. This resource covered: driver health; driving posture; risk management; car selection; working from the car training; and the cost-benefits of managing risk. For example, it included a car selection checklist (see section 2.4.3). A 'working from your car' postcard was also developed to raise driver awareness of the MSD risks.

Participation:

Based on questionnaire findings and interviews with workers, senior representatives in each organisation, some of whom were long-distance business drivers, discussed the findings and potential intervention activities. This resulted in the decision by senior representatives to use a train-the trainer approach to raise awareness of workers to the issues identified. The participatory approach also informed about the content of the training to be given the trainers, the online resource and the postcard.

Results:

The participatory approach raised management awareness of musculoskeletal symptoms in professional drivers, and the project was successful in affecting change at the management level, facilitated by the web resource. Organisations felt sufficient ownership of the project and developed their own solutions to the identified problems as a result of their association with the project.

Method and approach:

Multiple phases were addressed using various tools at different points including collaborative meetings, surveys, interviews, ergonomic training, and development of online resources.

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3.11.2 Simple improvements to make loading easier

Sector: Transportation and storage

Main method: Focus group (see section 2.3.1)

Key message:

Effective discussions with workers led to a new loading system that not only reduced the risk of MSDs, but enabled staff to load more rolls of product into each container. This produced large savings on transport costs, even though it took longer to load the rolls with the new system.

MSE relevance:

Involving workers in solution generation through focus groups is a simple method that is well suited for MSEs and facilitates collaboration in finding solutions between managers and workers.

Level of Participation:

The participatory approach had some predefined content, but both problems and solutions were identified and prioritised by the workers.

Country: United Kingdom

Organisation: Transport company

Participants: Managers and workers at a transport company.

Main health problem and hazards:

Workers suffered from neck and shoulder pain due to stacking the upper layers of a product in the delivery containers. It was a highly repetitive task involving manual handling of awkward loads.

Main action: Redesign of work procedures

Participation:

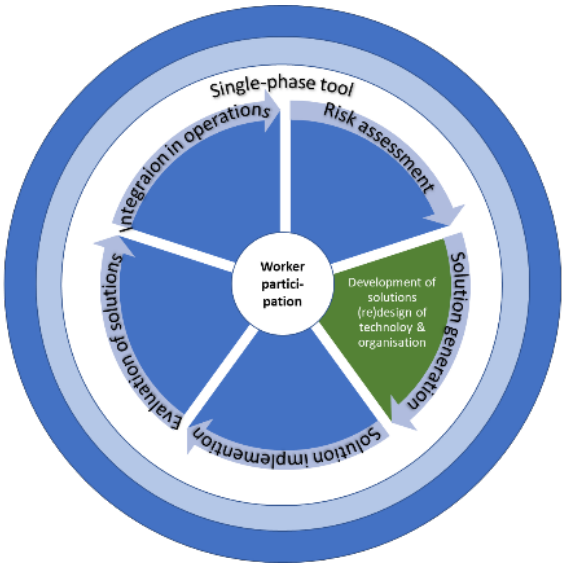
Managers and workers set up a focus group to consider solutions. It was not possible to change the product or its packaging, and as the company was relatively small, it was not financially viable to bring in a height adjustable conveyor. Instead, other options were explored, and the following practical solution was found: the nature of the load enabled a stable temporary platform to be formed within the container by placing boards on part of the bottom layer of rolls. A worker standing on this could load rolls up to roof height with much less effort than before.

Results:

Staff using the new method no longer suffered neck and shoulder pain. The new loading system not only reduced the risk of MSDs, but enabled staff to load more rolls of product into each container, which produced large savings on transport costs. The improvements cost only €1,745 to initiate and the payback period was under two months. Even though the new method of loading took more time, the reduced transport costs led to a net yearly saving of over €55,850.

Method and approach:

The focus group method is a simple method that engages different stakeholders in a process of creative co-creation and decision-making.



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3.12 Sector: Construction

3.12.1 Effects of participatory ergonomics in construction companies

Sector: Construction / construction industry

Main method: Implementation of new ergonomic tools, steering group, worker testing.

Key message:

Involving workers in the selection, testing of new ergonomic tools and use of ergonomic tools can lead to an increase in their acceptability and use in construction companies. Two strategies used to guide

the participatory ergonomics process: face-to-face guidance and online/email guidance, were equally successful.

MSE relevance:

The two guidance strategies were tested on SMEs and would transfer easily to other organisations and sectors.

Level of Participation:

Workers prioritised solutions and implementation strategies and were consulted in other phases.

Country: The Netherlands

Organisations:

SMEs in the Dutch construction industry with physically demanding jobs, such as laying floors, glazing, ironworking, plastering, paving, constructing walls and ceilings, carpentry or masonry.

Participants: Construction workers, predominantly men, in 12 companies with less than 50 workers.

Main health problem and hazards:

Construction workers face many MSD risk factors due to manual handling, repetitive work or working in awkward postures. Ergonomic tools – ranging from small hand tools to lifting devices can help mitigate some risks, but workers need to find the new tools acceptable and be willing to switch from their customary tools or work methods to the new tools and keep using them. Uptake can require training or a shift in work culture.

Main action:

The intervention led by an ergonomist to introduce new ergonomic tools and improve the use of existing ergonomic tools included: setting up a steering group; baseline and follow-up surveys; assessment of physical work demands; ergonomic training of a contact person for each company; selecting and testing the new tools; and implementation. An ergonomist guided the process, and one of the intervention's aims was also for the ergonomist to test the relative effectiveness of the online guidance and face-to-face implementation methods. With half the companies, the ergonomist guided the participatory ergonomic process through face-to-face meetings and telephone contact; with the other half, the process was guided by emails.

Participation:

In each participating company, a steering committee was formed consisting of the director, the prevention worker, work planners, supervisors and construction workers. First, the contact person of the company assessed the physical work demands of the workers and identified any potential new ergonomic tools. The contact person was supported by the ergonomic consultant who provided links to relevant websites, information folders and shared expertise. Next, the steering committee selected an ergonomic tool that matched the physical work demands of the workers. The selection process was facilitated by a self-made scorecard with respect to the tool (such as its availability), the behaviour of the construction workers (such as the need for training to work with the tool), and the organisation (such as its possibility to purchase the tool at short notice).

Following this, the ergonomic tool was tested by the construction workers in a test environment followed by discussions about the use of the ergonomic tool in daily practice. Experiences of advantages and disadvantages on the part of the construction workers on the ergonomic measures in daily work were identified by the steering committee, and a decision made as to whether to adopt it. Finally, an implementation strategy was decided upon.

After each meeting of the steering committee, all construction workers involved were informed about the process of the intervention. In this way, construction workers who were not part of the steering committee were able to provide input throughout the entire intervention.

This participatory process was implemented with guidance from an ergonomist using one of two strategies:

1. The ergonomic consultant presented the tool and the results of the workers' evaluations at a series of steering committee meetings (the face-to-face guidance strategy).

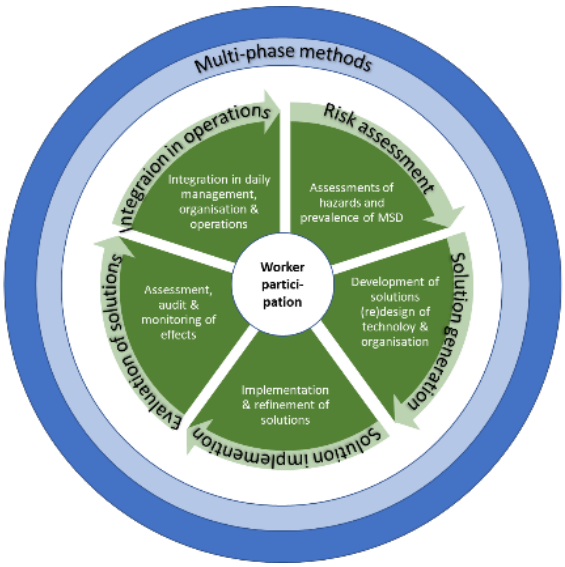
2. The ergonomic consultant guided the process through email correspondence with the contact person (the e-guidance strategy).

Results:

Both strategies used by the ergonomist to guide the participatory ergonomic process with the companies resulted in similar increases in the use of ergonomic tools, and equal levels of work ability, physical functioning, and limitations due to physical problems in workers. Both strategies are useful to support companies in introducing new ergonomic tools. However, the online method can have advantages in terms of time, elimination of travel costs, access to people and so on.

Method and approach:

The face-to-face and e-mail intervention strategies were both applied as single-phase tools during integration in operations, but the participatory approach leading to selection of ergonomic tools covered all phases of the participatory model.



References:

Visser, S., van der Molen, H. F., Sluiter, J. K., & Frings-Dresen, M. H. W. (2019). Evaluation of the effects of two alternative participatory ergonomics intervention strategies for construction companies. *Ergonomics*, *62*(1), 42-51. https://doi.org/10.1080/00140139.2018.1516806

Both guidance strategies are described in detail in:

Visser, S., van der Molen, H. F., Sluiter, J. K., & Frings-Dresen, M. H. W. W. (2014). Guidance strategies for a participatory ergonomic intervention to increase the use of ergonomic measures of workers in construction companies: a study design of a randomised trial. *BMC Musculoskeletal Disorders*, *15*(1), 132. https://doi.org/https://dx.doi.org/10.1186/1471-2474-15-132

3.12.2 Worker involvement in solution generation in road construction

Sector: Construction / road construction

Main method: Worker involvement in the design of new technology.

Key message:

The project outcomes show that participatory ergonomics and human-centred design have a positive effect on work culture and a positive return on investment; reduce risk of illness, injury and disablement; and contribute to health promotion. Key factors include a positive line of questioning to inspire workers to imagine and discover positive work design outcomes.

MSE relevance:

The methods used required an external consultant and involvement of an engineering supplier for design and construction of a custom-made trolley. Even so, the participatory methods applied during risk assessment and solution generation could easily be transferred to other companies experiencing a need for the design of a technological solution or redesign of workstations, and in particular, the appreciative inquiry technique used during risk assessment.

Level of Participation:

The project was not initiated by the workers; however, they influenced the prioritisation of tasks and solution generation. The workers were involved in risk assessment, solution generation and evaluation.

Country: Australia

Organisation: A multinational asphalt and construction materials company

Participants: Crew supervisor, roadwork team, investigator (ergonomist)

Main health problem and hazards:

The road construction workers experience a high prevalence of body stress, including sprain/strain injuries and MSDs. A high proportion is caused by hazardous manual task exposure during use of tools and equipment.

Main action:

Observations and interviews of workers as well as worker training (see section 2.3.7) led to the redesign of a manual task involving rolling out multi-laminate road tape with the fabrication of a customised trolley.

Participation:

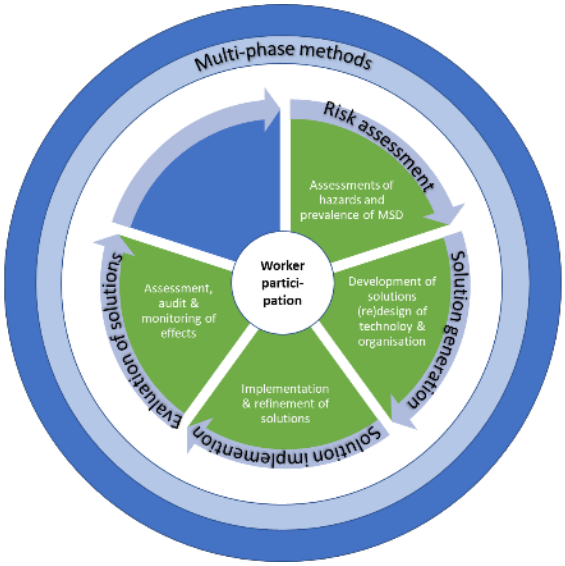
An external ergonomist initiated and managed the project. Focus of the project was determined through observations made by the investigator and interviews with workers followed by risk assessments. The interviews used an appreciative inquiry approach. Workers were trained in risk assessment and solution generation. The Design for Operability and Maintainability Technique (Design-OMAT) was carried out to improve the work design of the manual roll out of multi-laminate tape. The participatory approach included both direct participation of workers and indirect participation through the crew supervisor. The investigator ensured management support and funding for the project.

Results:

A trolley was custom-designed integrating tape roll out and paper spool collection tasks. The total task time was reduced from over 5 minutes to under 2 minutes per roll. Only one worker was required to operate the trolley, so the task was completed in shorter time leading to significant efficiency and cost savings. Workers were highly engaged in the process and the subsequent evaluation showed positive comments from the workers.

Method and approach:

Appreciative inquiry (investigator interviewing road workers), training in manual task risk identification; participative risk assessment (recorded using ErgoAnalyst™), and the Design for Operability and Maintainability Technique (Design-OMAT) are all multi-phase methods that potentially could be applied in several phases of a participatory approach.



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Hammond, S. A. (1998). *The thin book of appreciative inquiry* (2nd ed.). Thin Book Publishing.

Pazell, S., Burgess-Limerick, R., & Horberry, T. (2016). *Case Study: Participatory Ergonomics in Road Construction and an Occupational Perspective of Health* [Conference presentation]. Proceedings of the Human Factors and Ergonomics Society 2016 Annual Meeting, *60*(1), 999-1003. https://doi.org/10.1177/1541931213601232

3.12.3 Future workshops to reduce physical workload in construction

Sector: Construction

Main method: Future workshops (see section 2.3.4)

Key message:

Future workshops can be used to identify work hazards, prioritise work situations that need modifications, and suggest solutions. If the solutions are to be successfully implemented, management commitment and process for improving the work environment are essential. The technique of filming workers, then showing the videos and discussing them with workers can be very effective and provide more insight than just having researchers analyse the films.

MSE relevance:

The future workshops require a facilitator, but are easy to organise for an MSE. In this example, specialiased physical measurement equipment was used for the risk assessment, which is not feasible for all MSEs.

Level of Participation:

The method involves a high level of direct participation. Workers participate in risk assessments, solution generation and implementation.

Country: Denmark

Organisation: Three construction companies.

Participants:

40 full-time male construction workers (concrete workers and bricklayers) 19-67 years of age participated. A group of researchers guided the process.

Main health problem and hazards:

Upper and lower back pain and shoulder pain caused by tasks requiring excessive physical workload.

Main action:

Future workshops with construction workers combined with the use of technical measurements (physiological measurements and filming with a small video camera) were used to investigate tasks involving excessive physical workload during the working day in the construction industry and propose solutions for change.

Participation:

The workshops were organised in a 3-phase structure that builds on the future workshop principles. The first workshop consisted of three phases:

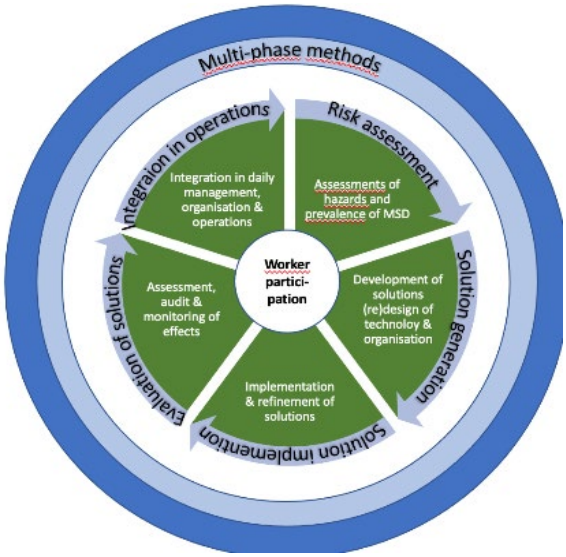
- *Critique* – Based on video recordings of the participants own work and measurements of the physical workload, the participants decided which work situations should be modified. The video recordings and physical workload measurements were conducted by the research team.
- *Utopia* – The participants discussed and described how the selected work situations could be carried out in the best of all worlds.
- *Realisation* – The participants considered possibilities and barriers and developed an action plan. Afterwards, the participants implemented the action plan. In the second workshop, the participants discussed the encountered barriers when implementing the action plan and developed further ideas on how to work towards the utopia. In the third workshop, the participants discussed and developed initiatives that could help ensure long-term implementation and sustainability of the solutions.

Results:

Most of the suggested solutions concerned technical assistive devices, but received limited managerial support because of costs related to purchasing. As a result, the risk assessments and future workshops did not reduce the number of events with excessive physical workload during construction work. However, the intervention did lead to a decrease in general fatigue and the workers felt that they had more influence on their own work. The project did support the development of one prevention measure. The findings of the project regarding physical load, together with input and ideas from the masons, supported the development of an electric stone cutter that cuts a brick with just a single press of a button, as opposed to a manual cutting device where the worker must provide physical force to cut the stone.

Method and approach:

This method is a multi-phase method that includes risk assessment, solution generation, solution implementation, evaluation of solutions and integration in operation.



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Skoglind-Öhman, I., & Shahnavaz, H. (2004). Assessment of future workshop's usefulness as an ergonomics tool. *International Journal of Occupational Safety and Ergonomics*, *10*(2), 119-128. https://doi.org/10.1080/10803548.2004.11076600

3.12.4 Taking the strain out of building work

Sector: Construction

Main method: Training in risk assessment and discussion about demanding work tasks.

Key message:

Training sessions do not have to be entirely 'one-way'. They can be used to gather information about the real work situation and to find solutions. Similarly, if the aim is to introduce work guidelines, worker participation will mean that more realistic guidance is developed.

MSE relevance:

	Medium	

This method requires a specialist with expertise in risk assessments and facilitation of discussion.

Level of Participation:

Low		

The participatory part of this method is considered low as most of the content is specified by the company's occupational health officer and on an informative level.

Country: Finland

Organisation: A residential and commercial construction company with more than 800 workers.

Participants:

Construction workers were involved in training sessions. The company's occupational health officer, a physiotherapist, and the work safety officer developed ergonomic activities.

Main health problem and hazards:

Workers suffered from MSDs and pain in the back, and upper and lower limbs caused by heavy lifting, awkward work postures and high workload.

Main action:

Workers participated in six 2-hour training sessions with discussions on how to make work tasks easier and lighter.

Participation:

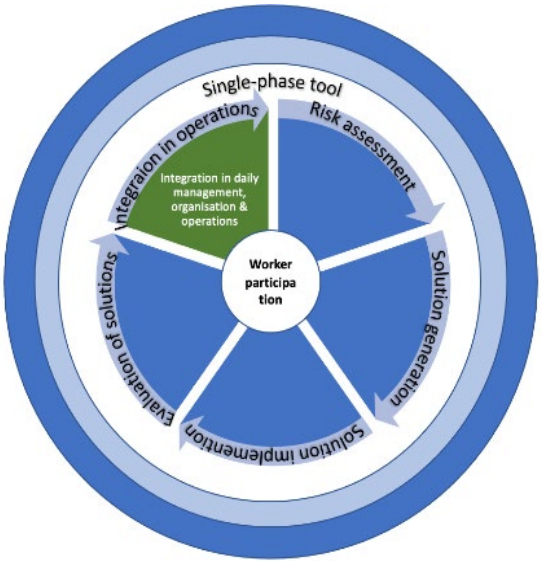
Participation involved group training sessions on evaluation of on-site risk factors using observation, photography (see section 2.3.3) and opinion polls. Work methods to make work easier and lighter were discussed during the sessions and the feedback was used to develop ergonomically sound practices which were subsequently implemented. This was a continuous process and, at a later stage, the practices developed with the workers' input were set out in a guide, which was distributed to all work sites. The guide with ergonomic ideas encouraged workers and supervisors to consider their own health as well as that of others.

Results:

The training sessions, discussions and the guide led to a reduction of MSD symptoms, a decrease of sickness absence due to MSDs, increased support from supervisors, and increased awareness of workload-reducing measures.

Method and approach:

This is a single-phase tool where the workers are encouraged to integrate the information on how they can make the work tasks easier and lighter in their daily work.



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3.13 Sector: Agriculture

3.13.1 The 'knife that cuts' approach in winegrowing

Sector: Agriculture / viticulture

Main method: Training in risk assessment and solution generation (see section 2.3.7). The method is an adaptation of a participatory method developed jointly by OSH intermediaries and a trade union in relation to using sharp knives for pruning work.

Key message:

Action training that incorporates solution generation is an opportunity to make workers aware of MSD prevention and apply prevention strategies. It also facilitates peer-to-peer learning. This approach, applied here to shears sharpening and wine operators, has been developed by several OSH French institutions. It could be adapted for use in other sectors and tasks. Knowledge of the sector and the training process were important for those conducting the training.

MSE relevance:

The method requires an external consultant qualified in the method. The training is aimed at all types of wineries including small ones.

Level of Participation:

The workers participate in risk assessment of pruning and debate alternative solutions considering prevention advice provided by the consultants. Workers are given the opportunity to develop implementation strategies by testing the quality of the sharpening in a pruning situation.

Country: France

Organisation: Several winegrowing enterprises.

Participants: Vineyard workers, owners and managers and the trainer. A trade union representative is involved in the steering process.

Main health problem and hazards:

Upper limb MSDs due to awkward postures and repetitive work. In the French agricultural sector, viticulture is the subsector most affected by MSDs. Pruning is a physical, repetitive work activity that is significantly affected by the quality and maintenance of the tools used, especially if the pruning tools (secateurs) are not sharp.

Main action:

Training in the choice and maintenance of cutting tools was carried out to introduce workers to MSD prevention. The prevention perspectives addressed take into account all dimensions of the work situation (characteristic of the pruning shears, organisation, and vineyard management). The training is offered by Mutualité Sociale Agricole (MSA). The MSA is a public agency that provides social protection for agricultural workers and is responsible for occupational risk prevention. The one-day training module is usually conducted by an OSH professional, an occupational physician from MSA and a secateurs specialist from MSA, who is trained to present the method.

Organisation and recruitment to the training was most effective when a steering group, or similar, was involved (for example, by involving local cooperatives, trade unions, sector organisations).

Participation:

This on-the-job training method incorporates the learning objectives/principles 'to be able to debate – to be able to think – to be able to act'.

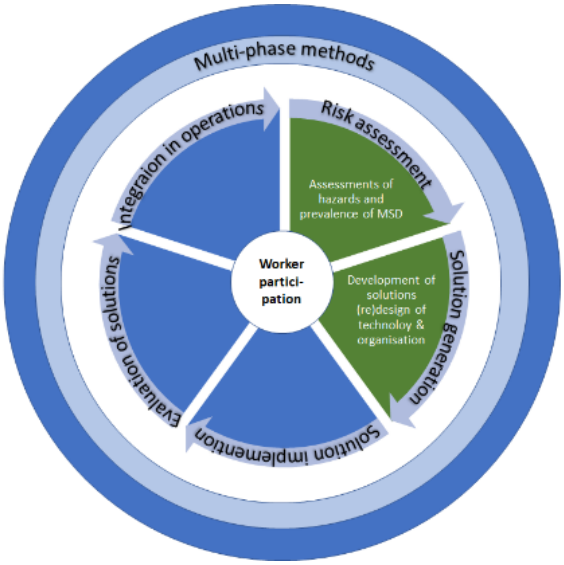
Workers are trained in techniques for using the pruning shears, especially sharpening the tools. The training provides an opportunity to build a common vocabulary and debate about their own practice. Practical sessions in work situations in a vineyard allow the participants to identify the risk factors and to practice possibilities for improvement. A few months after the first training session, the workers meet again with trainers. Discussion is centred on practical experiences since the first meeting (see section 2.3.5). The contextualisation of occupational risks and prevention actions in relation to the practical work situations allows constructive discussion, avoiding a negative 'what to do' and 'what not to do' approach. Indeed, the discussion allows know-how sharing between peers and then development of new skills adapted to trainees' work context. A representative from the trade union can participate in local steering groups and subsequently gain the skills to be able to organise the training themselves. Partnership among employers, unions and OSH professionals can consolidate the prevention activities over time and permits going beyond the prevention of MSDs.

Results:

The cutting power of the secateurs increases with proper sharpening, which is a key factor in the prevention of upper limb MSDs. The presence of a supervisor during the training facilitates the implementation of preventive measures, as the supervisor may reorganise work by integrating the prevention principles. The successful implementation of the preventive measures depends on having sufficient time for exchange between participants during the training.

Method and approach:

During training, workers assess hazards during pruning and generate solutions in a preventive perspective.



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3.14 Sector: Professional, scientific and technical activities

3.14.1 Ergonomics as a partner for industrial and human performance

Sector:

Professional, scientific and technical activities / laboratory in industrial sector

Main method: Workshops, supported by preliminary interviews and observation.

Key message:

In the context of a general reorganisation of a laboratory, integration of worker participation in daily operations and consideration of ergonomics led to a sustained increase in production.

MSE relevance:

The ergonomic intervention requires an ergonomic specialist. Implementing the lean methodology requires specialised skills.

Level of Participation:

Workers participated in solution generation and identification of implementation strategies. Risk assessments were performed by an external ergonomist.

Country: France

Organisation: A 200-person laboratory of an international company.

Participants: Operators, technicians, managers, project managers and production manager.

Main health problem and hazards:

The company experienced a high number of reported MSD complaints from workers. The ergonomist identified several risk factors: production rate increase, carrying loads, repetitive tasks, cramped workstations and unsuitable working heights and methods, working at low temperatures in constrained postures, and mental workload. The work of the different work units was very interdependent. The company also wanted to improve production efficiency.

Main action:

Following an analysis, which included observations and interviews with workers, an ergonomist held a series of workshops with workers and managers to generate, implement and integrate sustainable workplace solutions. The intervention took place at the same time as a refurbishment. The aim was to combine ergonomic work principles with lean production principles (see section 2.4.6). The organisation was also taking a participatory approach to the implementation of lean principles. The lean tools had already been adapted to the laboratory setting.

Participation:

Workers from different work units participated in three workshops to discuss work-related hazards and potential solutions. The workers already had experience with participation in work organisation through implementation of the lean approach. Before holding the workshops, an ergonomist had conducted a work activity analysis through observations and interviews. In the first series of workshops, workers discussed and validated the findings of the analysis and investigated possible solutions. The discussions allowed workers to understand the work of other colleagues, the challenges it posed and their vision of their work in terms of prevention. Understanding the work of others was crucial because how tasks are performed in one area of production affect the work in another area, both in terms of worker wellbeing and production efficiency. In the following days, workers themselves took the initiative to change some

of the work processes. To operationalise the results of the first-level workshops, a second level of workshops were conducted with workers in charge of the processes and equipment.

Finally, a third level of workshops with groups composed of operators, managers, and workers in charge of the processes and equipment were organised to validate the suggested solutions and reach agreement on which to implement. The workshop participants designed a detailed action plan by work unit.

The ways of working and working conditions were examined jointly with the processes carried out (work safety was looked at together with production efficiency), bringing the human dimension into the examination of industrial performance.

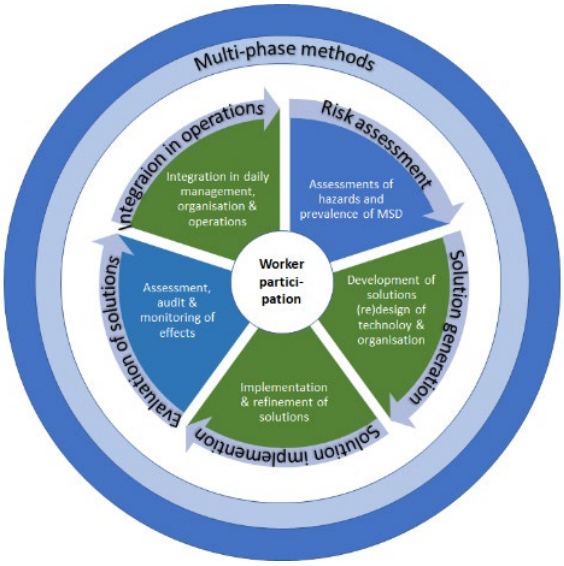
Results:

Managers adopted the ergonomic approach to implement changes. This strongly contributed to the improvement of the working conditions in a sustainable way and to a decrease in MSDs. A diverse range of changes were made, from the height and layout of workstations to changes in the organisation of production.

The 'permeability' among units during the workshops led to creating links between the different teams. All stakeholders adopted the participative approach, making it part of everyday work life. The previous practice of lean methodology was also a facilitating factor.

Method and approach:

This is a multi-phase method where workers participate in the development and implementation of solutions, and in their integration in daily operations.



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3.15 Sector: Financial and insurance activities

3.15.1 Participation in design of new ergonomic cashier desks

Sector: Financial and insurance activities

Main method: Consultation with workers when redesigning customer service desks. Workers also pilot tested the use of the proposed design.

Key message:

When redesigning facilities, it is valuable to consult with frontline workers to ensure the proposed solutions reduce the risk of MSDs.

MSE relevance:

Consultation of frontline workers is easily conducted. Redesigning facilities likely requires external assistance of consultants and designers, which may be costly.

Level of Participation:

This method has a medium level of participation as the redesigning task was predefined, and the workers were mainly involved through consultation only.

Country: Cyprus

Organisation: Bank of Cyprus

Participants:

In total, 35 participants took part: frontline workers in a bank (cashiers), management of the bank, a health and safety officer, external consultants including a designer and a risk assessment advisor.

Main health problem and hazards:

Cashiers complained of MSDs caused by prolonged, fixed, seated workings positions when they serve customers at the desks.

Main action: Consultation with the cashiers to identify ergonomic design issues with the desks.

Participation:

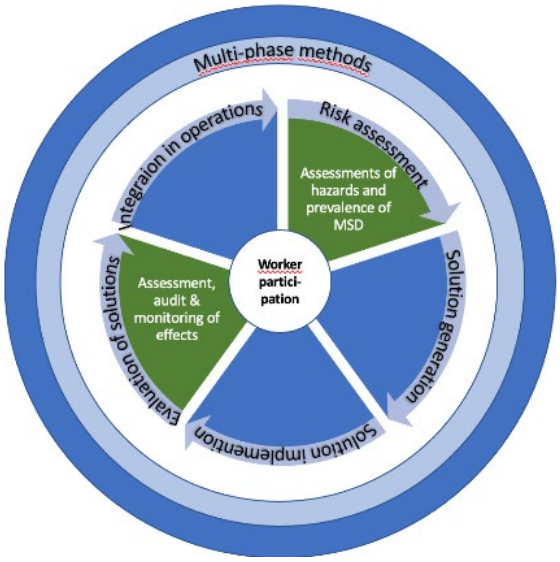
The cashiers participated in identifying ergonomic issues to ensure a good ergonomic design of the desks. In addition, the management and safety and health officer were consulted. Selected cashiers pilot tested the new design.

Results:

The cashiers were happy to be involved and contributed valuable information about the challenges they experienced daily.

Method and approach:

This is a multi-phase method including risk assessment, where the workers were consulted about ergonomic design issues, and evaluation of the redesign of the customer service desks. (See section 2.4.7).



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3.16 Sector: Mixed - public service and food and cleaning

3.16.1 Schools and kindergartens as shared workplaces

Sector: Public service and food and cleaning

Main method:

Root cause analysis and participatory workshop development sessions based on the lean method 5S, combined with initial interviews and work observations.

Key message:

A combination of a lean method and workshops can engage the target group and other relevant stakeholders in a shared workplace and help to develop solutions that decrease physical burdens for the target group. It can be important to involve a broader range of stakeholders, not just the workers directly concerned.

MSE relevance:

This method is low-cost and can be carried out without the involvement of external consultants or the need for specialised equipment. It allows the possibility to implement easy changes.

Level of participation:

This method has some predefined content due to initial analysis of risks and challenges by the researchers, and the influence of workers is in only two phases. Otherwise, many and different participants are involved in discussing the assessed risks and generating solutions to the risks and challenges.

Country: Finland

Organisation:

A municipal, in-house meal and cleaning service catering to two public kindergartens and four public schools.

Participants:

The target group was meal and cleaning service employees, but stakeholders from all groups of the targeted workplaces participated in the development process (such as meal and cleaning service employees, librarians, teachers, HR coordinator, supervisors, OSH actors of the meal and cleaning services provider, and facility technical services/municipal real estate management department).

Main health problem and hazards:

The meal and cleaning service workers were encountering challenges due to an increase in the average age of employees, a decrease in recruitment, and changes in work tasks, sites, and communities**.** These factors were causing physical and psychosocial burdens among the workers that could lower their work ability and productivity.

Main action:

Workshops using a lean method were conducted, aimed at engaging all stakeholders in the involved workplaces in improvements.

Participation:

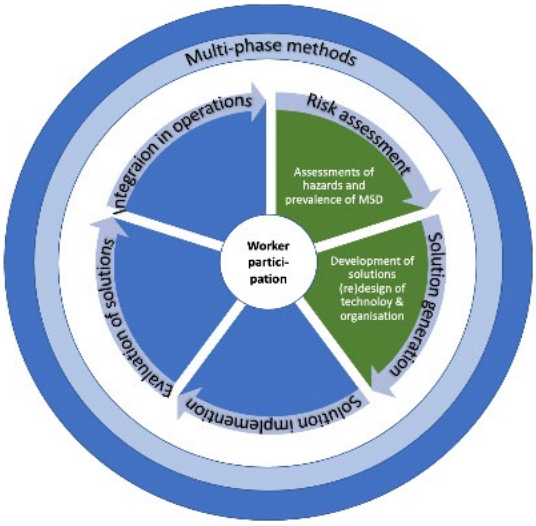
External researchers did an initial assessment of the meal and cleaning workers' practices and the risk factors they were exposed to, which was the foundation of the workshops. Workshops, facilitated by the researcher, were held at each workplace with the participation of meal and cleaning service workers and other relevant stakeholders. At the workshops, the participants developed solutions to the assessed risks/challenges. To do this, the lean method '5 Whys' was used (see sections 2.4.1 and 2.4.6). The question 'Why' was asked five times to identify the root causes of the problem, and the subsequent question 'How' was used to solve the identified problems.

Results:

The workshops led to new practical ideas and sharing of best practices that were already in use. In the workshop, the participants assessed different challenges such as kids playing in the facilities during cleaning, or machines that need to be lifted passing stairs. Solutions were found to almost all of the identified challenges, and actors needed to implement the proposed solutions. This collaboration between the service workers and other workplace stakeholders proved to be valuable in reducing the physical burden. For example, the collaboration between the meal and cleaning workers and the municipal real estate management department became an important part of the implementation of improvements. Therefore, regular meetings involving all stakeholders opened possibilities for continuous improvement.

Method and approach:

This is a multi-phase method that covers risk assessment and solution generation.



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3.17 Sector: Mixed – manufacturing, administrative and support service activities

3.17.1 Video recordings to re-think the participants work

Sector: Mixed – manufacturing, administrative and support service activities / grave-digging

Main method:

A combination of video, observations, interviews and biomechanical monitoring was used for Cross Self-confrontation (workers reflect on their own work). A steering committee oversees the intervention.

Key message:

The Cross Self-confrontation approach used here allows workers to see how they and others work. Reflecting on their work tasks and postures and discussing them with colleagues helped workers to understand how work was affecting their health and how their work could be improved.

MSE relevance:

Cross Self-confrontation based on video recordings makes changes easy to implement. It is a low-cost method that does not need an external consultant, specialised training or equipment.

Level of Participation:

Cross Self-confrontation is a multi-phase method with participation of workers in two phases: risk assessment and solution generation.

Country: France

Organisation: Municipal authority, gravediggers in a large French city.

Participants: The target group was 8 volunteer gravediggers, but the occupational physician, other workers and managers were also involved in some stages.

Main health problem and hazards:

Gravediggers experience shoulder and lumbar pain caused by unearthing tombstones, digging, exhumation and inhumation. This case focuses on the digging activity, where gravediggers manually excavate graves using shovels, picks, spades and forks. Manual excavation is required in the oldest cemeteries because topographical constraints restrict the use of machinery.

Main action:

Based on video recordings and monitoring of their physical activity (see section 2.4.4), the gravediggers engaged in a dialogue and collective re-thinking of their work activities.

Participation:

Cross Self-confrontation uses detailed, dialogue-based and transformational reflection about workers' tasks and work postures. The goal is to help workers and managers reflect on their work and how it affects their health, so they can re-think and transform the work.

Researchers conducted an analysis of the gravediggers' work activity using observations and interviews, followed by biomechanical monitoring and filming of selected tasks using volunteers.

In the first step of the intervention, the gravediggers and the occupational physician decided to focus on throwing soil backwards over the shoulder when digging, as it was considered to be the most painful part of digging. Eight volunteer gravediggers then took part in a biomechanical study of the over-the-shoulder soil throwing. They were measured and filmed at the same time. The most painful and least stressful soil throw was defined for each worker. Each gravedigger was shown their videos and asked to compare their ways of working with those of others (self-confrontation phase).

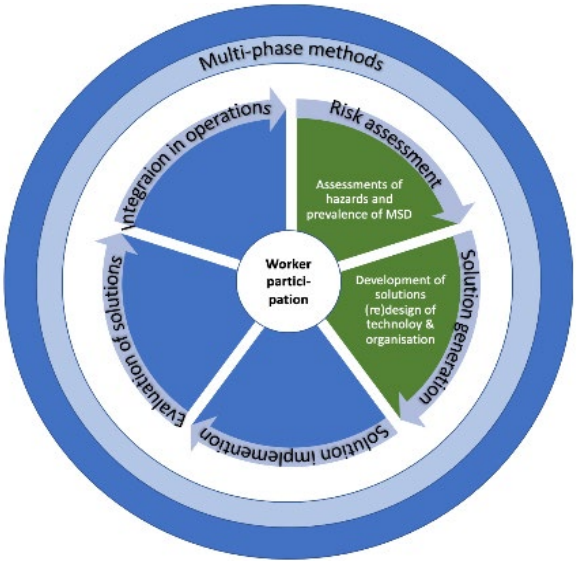
Next, the gravediggers were divided into pairs for the cross self-confrontation. Then the researchers encouraged the gravediggers to compare their own movements with their colleagues' movements, looking at their differing ways of working. With the facilitation of the researchers, this opened a discussion of new possibilities on how to perform their work with lower exposure to MSD hazards (see section 2.3.5). The use of video allows workers to see and discuss how tasks are really done in practice. The outcomes are then discussed in a broader forum with other colleagues, managers and a steering committee, which was formed at the beginning of the process.

Results:

Cross Self-confrontation discussions helped the workers and managers to transform their views on health, work activity and constraints and to experiment with alternatives for health protection. Together with the gravediggers, managers reconsidered the design of occupational training regarding the body movements used for soil throwing. After the intervention, gravediggers began to speak with the occupational physician not only about their aches and pains, but also about constraints they face doing this physical activity.

Method and approach:

Cross self-confrontation is a multi-phase method, focusing on risk assessment and solution generation.



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4 Case studies of worker participation in MSD prevention

4.1 Introduction to case studies

This chapter contains nine case studies of successful worker participation in MSD prevention (table 3). The cases were selected from over 50 examples; the main criteria for selection were that the cases represented important principles for worker participation and that sufficient in-depth information was available. The study material included evaluation reports, scientific publications, internal company material and interviews with key stakeholders from the cases. Five additional cases provided by EU-OSHA were also included in the analysis.

Table 3 Nine cases of worker participation in MSD prevention

Case reference number and title	Country	Sector	Organisation
Case 1 - Involving workers in planning a safe and ergonomic carpentry workshop using the SOBANE method and simulation	Belgium	Materials and processing	Provincial authority
Case 2 - Workshops with childcare workers to reduce musculoskeletal disorders	Denmark	Human health and social work activities	Public and private childcare institutions
Case 3 - Participatory workshops with female food preparation workers to find solutions to musculoskeletal problems	Finland	Hotels and catering	Multiple public sector canteens/kitchens
Case 4 - Using the TMS Pro participatory approach to reduce musculoskeletal disorders for packaging line operators in agribusiness	France	Agribusiness	Food packaging company
Case 5 - Improving equipment by involving workers to prevent manual handling risks in a PVC plant	France	Manufacturing	Multinational organisation
Case 6 - Training hotel service workers as prevention coordinators to work with colleagues to prevent musculoskeletal disorders	France	Hotels and similar accommodations	Hotel
Case 7 - Reducing musculoskeletal disorders of viticulture workers through a participatory approach involving video analysis	France	Agriculture sector	Vineyard
Case 8 - Participatory approach to reducing risks associated with musculoskeletal disorders for maintenance technicians	Ireland	Manufacturing	Manufacturing site
Case 9 - Worker participation to prevent musculoskeletal disorders in the assembly of boilers	Italy	Manufacturing	Manufacturing site

In the analysis and presentation of the cases, the focus is on highlighting the features which make worker participation successful. The case studies focus on two aspects: 1) how workers were actively involved, and 2) how their participation contributed to the identification and implementation of effective preventive measures. Furthermore, the context of each case is described to provide an understanding of the conditions that facilitated successful worker participation.

The chapter concludes with a cross-case analysis. This includes the general lessons that can be drawn from the cases as well as supporting evidence from the methods, approaches, and short descriptions of other examples in chapters 2 and 3. This analysis is built on the idea of a realist evaluation and the Context-Mechanism-Outcome configuration (Pawson & Tilley, 1997). The idea is to identify under what conditions a specific mechanism (effort, instrument, or method) will work, for example, cause the expected outcome. The output of the analysis thereby provides a guide for practitioners and professionals in improving the effectiveness of worker participation in MSD prevention.

4.2 Summary of the cases

Case 1 - Involving workers in planning a safe and ergonomic carpentry workshop using the SOBANE method and simulation

In the context of reorganising the departments of a Belgian regional authority, an in-house ergonomist implemented a participatory approach with the carpentry department team to design their future workshop. The carpenters were involved in all phases of the project. The risk analysis was performed using the SOBANE participatory method. The organisational and spatial 2D model-based simulation of the future workshop with the carpenters led to the decision of the new workshop's specifications. The carpenters felt that their voices had been heard, that they were genuinely involved in the project and recognised for their contribution. The participatory approach and the simulation made it possible to consider the overall reality of the carpenters' situation and anticipate design errors.

Case 2 - Workshops with childcare workers to reduce musculoskeletal disorders

A 20-week intervention for childcare workers consisted of three workshops with focus on identifying hazardous work tasks related to musculoskeletal pain and implementing solutions to reduce the risks. The participatory intervention included all workers and used a six-step systematic approach for identification and analysis of work-related risks, and solution generation and implementation. The intervention resulted in an 88% reduction in pain-related sickness absence. Key elements of the approach were the workers' prioritisation of the most important child-caring tasks and the focus on integration of solutions with these tasks.

Case 3 - Participatory workshops with female food preparation workers to find solutions to musculoskeletal problems

This intervention involved multiple kitchens and aimed to decrease musculoskeletal problems using ergonomic solutions. Through workshops and onsite activities, the workers were trained in task analysis; they identified hazards, analysed and designed solutions to the problems and implemented changes. The intervention was supported by an external expert. Along with MSD risks, psychosocial stress factors associated with the work tasks were also addressed.

Case 4 - Using the TMS Pro participatory approach to reduce musculoskeletal disorders for packaging line operators in agribusiness

The management team of a factory group decided to implement a participatory approach to prevent MSDs, injuries and absenteeism caused by stress and strain. Over a four-year period, the factory benefited from the TMS Pro approach supported by the Health & Performance programmes run by a sector advisory service. Two external professionals encouraged the company to improve their existing approach by taking real working conditions into account. The involvement of all management levels, coordination by a group of 'resource' persons, the processing of worker feedback by management, and the institutionalisation of regular discussions with the workers about work constituted key factors for success. Today, the site is pursuing its participatory prevention policy on its own. The number of MSD and occupational injury reports has dropped.

Case 5 - Improving equipment by involving workers to prevent manual handling risks in a PVC plant

In a PVC processing plant, loading three-metre long planks into containers and moving those caused MSD risks due to manual handling. A robotic system reduced the manual handling risks but introduced new safety risks. Collaborative work teams investigated the risks, supervised by the safety committee and the external regional health insurance fund. This resulted in adaptations to the machines and putting the loading containers on wheeled trolleys. Changes were made gradually, looking at different options

and amending those that proved unsuccessful. The process was supported by a commitment from the plant director to continuous improvements in working conditions, such as delegation of responsibility to teams and a suggestion scheme.

Case 6 - Training hotel service workers as prevention coordinators to work with colleagues to prevent musculoskeletal disorders

A hotel had a significant problem with worker absenteeism due to serious musculoskeletal problems. With the involvement of a regional OSH prevention organisation, volunteers from among the hotel's cleaners and linen and catering staff were trained as prevention coordinators. Bringing their own experience of the work tasks, they looked at problematic day-to-day activities to find practical solutions using observation and discussion with co-workers. In addition, staff surveys and other communication methods were used with all the workers, and the external suppliers and their workers were also involved.

Case 7 - Reducing musculoskeletal disorders of viticulture workers through a participatory approach involving video analysis

MSDs were frequent among workers pruning grapevines. An ergonomic intervention combined video analysis of work tasks with worker participation. A team of workers and the managing director was set up and they were trained concerning MSDs and possible solutions. Workers were filmed in better and poorer working conditions to capture all aspects of the work. Their working postures and workloads were scored by a consultant and the scores were then checked with the working group to take into account workers' individual experiences of the same tasks. The working group then researched solutions and decided how the agreed solution would be tested, using the same video analysis process. This ensured that workers checked how the solution worked in practice before it was fully implemented. The chosen solution was the introduction of a seat to help eliminate poor postures and reduce excessive fatigue.

Case 8 - Participatory approach to reducing risks associated with musculoskeletal disorders for maintenance technicians

Maintenance workers were encouraged to report any tasks which they found difficult or uncomfortable. This led to technicians reporting the changing of a blade on a granulator, which could only be done in an awkward kneeling position in a confined space. Together, the safety and health coordinator, the operators and the maintenance workers performed an ergonomic video assessment of the task in question. Possible solutions were identified together with the workers during a brainstorming process. The final solution was a modification of the existing platform that permitted maintenance workers to perform the task in a comfortable standing position; this change was also more time efficient.

Case 9 - Worker participation to prevent musculoskeletal disorders in the assembly of boilers

A four-step intervention for industrial workers was organised to identify and prioritise ergonomic and safety risk factors as well as to assess and develop preventive measures. The participatory approach consisted of a combination of focus groups and fault tree analysis to facilitate discussions and gain knowledge about problematic areas in OSH in the workplace. 31 assembly workers were involved. The workers were actively involved and improved their own attention to and recognition of near misses and potential high-risk conditions for MSDs or injuries.

Table 4 summarises the methods used in each case and who was responsible for conducting and overseeing the process.

Table 4 Overview of methods used at different stages in the nine cases

Stage	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Risk assessment	Observation Workshop Risk screening tool and questionnaire	Workshop	Workshop Training of workers Questionnaire	Questionnaire Meetings Administrative data Observation and photo	Meetings	Training of workers Prevention coordinators Observation and photo/video	Video Discussion	Questionnaire Video	Questionnaire Fault tree analysis Focus groups
Solution generation	Simulation Discussion Visits to other worksites	Workshop Tool for prioritising risks	Workshops Visits to other worksites	Working group Simulation Testing	Working groups Suggestion sheets	Action plans	Discussion Testing	Workshop	Focus groups
Solution implementation	Testing Discussion	Action plans		Action plans	Action plans Health and safety committee		Testing Video	External consultancy	
Evaluation of solutions	Discussion	Workshop		Testing Discussion	Performance reviews	Feedback	Testing Video		Questionnaire Focus groups
Integration in operations		Action plans		Training of workers Observation Discussion			Discussion		
Process facilitation	Internal trainee ergonomist	Research team and external OSH consultants	External OSH consultant	External OSH consultant			External OSH consultant		Research team
Project management	Steering committee	Research team	Steering committee	Steering committee	Management	Management	Management	Management	Research team

4.3 Case 1 - Involving workers in planning a safe and ergonomic carpentry workshop using the SOBANE method and simulation

General information

Country: Belgium

Sector: Materials and processing

Type of organisation: Provincial authority

Size of organisation: 1,250 workers. The team involved in the approach is part of the Service technique du patrimoine immobilier (property assets technical department). The team has 3 carpenters included in a group of 22 workers from other professions.

Location: Urban

Job/tasks: Carpentry

Workplace and task characteristics: Build and maintain furniture, transport goods, almost permanently working in a static standing position.

Workplace participation measures: Carpenters participated in analysing work and risks, as well as defining specifications for the development of their future workshop based on simulation.

The action

- **Background**

Project start-up

The property assets technical department (which carries out repairs and maintenance) for the province of Namur is spread across several buildings. Namur planned to modernise and combine the separated units in one building. However, the manager of the unit was not convinced that the right building had been chosen. The province had several projects underway to improve working conditions in the carpentry department. These projects addressed the considerable risks from carpentry activity, such as musculoskeletal disorders (MSDs), safety, noise and dust, and the high level of absenteeism. Furthermore, this was the first department to start activities after the relocation to new premises.

To develop the new carpentry workshop, the employer decided to ask the prevention department's trainee ergonomist to provide ergonomic input to the project. The site for the carpentry department and the size of the workshop had already been defined by the project architect. To define the sizing needs of the premises, the architect had only based his choices on the standard measurements of the workshop machines. He did not consider their real operational space requirements and did not consult the carpenters.

The ergonomist introduced a participatory approach to help produce a development plan for the new workshop. The approach was used to establish technical and organisational recommendations to ensure the carpenters' wellbeing and performance. The unit manager saw this as an opportunity to demonstrate to senior management that the building chosen and the space allocated were not suitable.

The department is now located in a larger building than the one initially planned.

The carpentry department

The carpentry team oversees building and maintaining furniture for the Namur province departments: draw plans on the computer, manage stock, cut and machine wooden parts, assemble, paint, and manage waste. The activity has a substantial impact on lower back and lower limb disorders. The carpenters associate these physical difficulties with the job's static position and the fact that they have to stand most of the time when they are working.

Prevention policy

The province of Namur has set up a dynamic risk management system. The objective is to foster employee wellbeing, and it includes an overall risk analysis approach for each job. There is no specific approach for preventing MSD.

The workers follow basic OSH training when they are hired. On the inception day for new employees, the prevention department gives a 30-minute presentation of the wellbeing policy while other agents working for the employer also provide input.

Participatory culture

Department heads are required to perform a risk analysis for each new worker recruited. When called on by the person in charge of a department, the prevention department specialist actively involves the department operators in the risk analysis and the identification of preventive measures.

In the property assets maintenance and repair unit, the person in charge organises daily meetings with all employees to present the schedule for the day. These meetings do not really encourage dialogue between the managers and workers when they could in fact be an opportunity for the workers to report problems. The manager wanted to invest in a new machine to reduce supplier costs. He presented several models to the carpenters who were able to give their opinion about the most suitable machines for their activity.

- **Participants and stakeholders**

Two of the three workshop carpenters were involved in the project. The third carpenter was on long-term sick leave. These two carpenters had been working in the workshop for five and seven years, respectively. They took part in all the phases of the project, from analysing risks to defining specifications for the development of the new workshop, especially through a model-based simulation.

The ergonomist was involved in the project as part of his Master's degree specialising in risk management and wellbeing at work. Moreover, he had worked for the Namur province prevention department for 18 years. He coordinated the various steps of the ergonomic approach and took part in the development project steering committee. The person in charge of the property assets maintenance and repair unit had occupied his position for 23 years. He followed the project and participated in the steering committee. He referred to the specifications drawn up by the operators and ergonomist to define the second building development. The civil servant (trained architect) in charge of monitoring the project to combine the departments for the project owner also participated in the steering committee. Trade union representatives were asked to validate the action plan, but did not participate in the project management.

- **Participatory approaches, methods and tools**

Overview of the approach

The ergonomist presented the approach during a meeting with the managers and carpenters. He suggested following the Screening, Observation, Analysis, Expertise (SOBANE) method to perform risk analysis and simulation in developing the new workshop. In this health and safety risk management strategy, all actors actively participate in screening for potential safety risks and finding solutions.

Risk analysis based on the current situation

- After observing the carpenters' activity for a day, the ergonomist organised an immediate debriefing session with them in the workshop to share his first observations and start discussions about work-related difficulties.
- Based on this first step, he designed a workshop plan considering the working space around the workstations. At the workshop, the carpenters could present their activity in relation to the plan. This step was used to determine the traffic flows.
- To complete the data, an overall risk analysis was performed with the two carpenters present during a 3-hour meeting. The Déparis consultation guide (participatory risk screening) for the wood sector was used to support this work. The manager was also invited but did not attend, which allowed the carpenters to speak more freely.

- At the end of the meeting, the ergonomist summarised the discussions, inviting the carpenters to make any adjustments to the report.
- This first step showed there was a need to perform a more in-depth analysis of the risks relating to MSDs, lighting and noise. The ergonomist assessed the MSD risks using a questionnaire based on a scale of discomfort (Corlett and Bishop, 1976), which the carpenters had filled in. The ergonomist then discussed the results with the carpenters. They guided the ergonomist as he measured the noise and lighting levels in the workshop according to the work activity.

Finding solutions

The results of the risk analysis were presented to the steering committee in the presence of the carpenters. The steering committee members decided to visit another carpentry workshop in the city. Their tour of this workshop and discussions with its users led to new ideas emerging for the future workshop development.

The ergonomist built a large 2D plan on which sticky notes were placed to represent the tools and machines to scale. Over the course of two days, the carpenters progressively simulated different organisations and space scenarios. The ergonomist supervised each simulation iteration. The strong points and constraints identified in the previous step were taken into account. Various design aspects relating to the premises emerged during the simulation: air exhaust system, general layout, noise, entrance door, light, storage, signposting, handling equipment and height-adjustable workbenches.

The resulting plan and design recommendations for the premises were presented to the steering committee. Following this presentation and the ensuing discussions, the carpenters, guided by the ergonomist, took half a day to make some readjustments.

From an organisational point of view, the improvement proposals were put together by the workers and the ergonomist. These included raw material order management, which was seen as a source of stress. These recommendations were then discussed and validated during a steering committee meeting.

Finally, the planned workshop was found to be unsuitable because it was too small to accommodate one of the machines (the wood panelling machine) and the space required around it to work. Therefore, management decided to move the carpentry workshop to a bigger building and allocate more space to it.

Based on the plan drawn up by the ergonomist and the carpenters, as well as the design recommendations, the person in charge of the department and the architect designed the machine layout in the new space. The manager then validated this layout with the carpenters.

Implementing solutions

During the move, the carpenters suggested swapping the positions of the two machines that took up the same amount of floor space. Their request was accepted. The two carpenters also took part in a team of ten workers in charge of the new building development project.

- **What was achieved**

Finding solutions

The participatory approach and the simulation made it possible to propose a workshop plan placing the different workstations and machines in a way that reflects the real-life situation of the carpenters. In this way, problems relating to health and performance could be avoided. For example, one of the machines occupies three times more space when operating than it does when it is not operating. The first plans drawn up by the architect only considered the space requirements of the machine when it was not in operation.

Several design and equipment recommendations were made by the operators, the manager and the ergonomist:

- Equipment recommendations for MSD prevention (assistance with manual load handling): pallet truck, forklift truck, footrest bar systems installed below the workstations, loading bay to facilitate the transfer of parts and waste from the workshop to the vehicle, and height-adjustable workbenches.

- Organisational recommendations: reorganisation of waste disposal, storage and supplies.

These solutions were being implemented at the time of this case study.

The workers' experience

The carpenters felt that they had been heard, were involved in the project and recognised for their contribution. All the department's workers, including the carpenters, who took part in the development project were able to strengthen their work collective.

Improvements

The modifications better satisfied the needs of the carpenters' activity while protecting their health and wellbeing. Encouraged to be involved in each phase of the project thinking, the carpenters actively participated in analysing risks, defining specifications and moving to the new premises.

The participatory ergonomic approach implemented by the ergonomist was a first experience for the authority. Following the ergonomic intervention, the manager used the experience to appoint 10 workers to be in charge of the new building development project. During the project, he visited the site two to three times a week to meet up with the workers and collect their feedback. The ideas suggested by the team were taken into account.

- **Case extract**

The ergonomist and the manager were committed to their mission, facilitating worker participation and anticipating production system transformation projects. The ergonomist communicated regularly with the manager to review the progress of the intervention. The manager was reassured about what was happening between the ergonomist and the carpenters.

Members of the steering committee decided to visit an external workshop. Their tour of this workshop and discussions with its users led to new ideas emerging for the future workshop development.

Analysis

- **Barriers**
  - The ergonomist was invited by the employer to be part of the overall development architecture quite late in the project.
  - The small budget made it difficult to buy new equipment.
  - Workers were involved only after the initial decisions on space had been decided. Although they were involved before it was altogether too late, involving them earlier could have avoided, for example, the mistake about the real space needed to operate one of the machines.
- **Facilitators**
  - The ergonomist had worked in the company for many years and thus benefitted from his seniority.
  - He carried out this study as part of his Master's degree and was therefore able to formally put into practice his skills.
  - He suggested to management that a participatory approach should be implemented with a steering committee and involve the workers in each step of the project management.
  - The workers put more effort and time into the project because they were included in the thinking around it.
  - The participatory approach created a dialogue between the managers and the employees: the employer invited the group members to take part in the meetings.
  - The methodology was based on the actual work activity.
  - A group tour to a different workshop allowed new ideas to emerge for making the project a success.
  - The simulation of the future workshop encouraged the carpenters to think ahead and anticipate design errors.

- **Innovative features**
  - Analogue simulation made the design transparent and easy to change.
  - Workers participated from beginning to end.
  - Visits to the other workshops.
- **Lessons learned**
  - The participatory approach and the simulation made it possible to consider the overall reality of the carpenters' situation and prevent health problems from arising.
  - According to the ergonomist, the workers' involvement in the project thinking, rather than simply having decisions imposed on them, meant that it was easier to gain their acceptance of the dynamic risk management system set up by the employer. In the future, they will be more inclined to pay attention to the collectively identified risks and make proposals.
- **Transferability**

The SOBANE method for participatory risk analysis and simulation can be used in all business sectors and in companies and organisations of different sizes. In a small company, the various SOBANE guides indicate which actors need to be involved at which stage. There are websites to help with the implementation of workspace simulation. The use of a whiteboard with sticky notes is a simple method that can easily be applied by a micro and small enterprise.

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In addition, the case description builds on two interviews with the ergonomist and the manager of the property assets maintenance and repair unit.

4.4 Case 2 - Workshops with childcare workers to reduce musculoskeletal disorders

General information

Country: Denmark

Sector: Human health and social work activities

Type of organisation: Provincial authority

Size of organisation: Public and private childcare institutions for children aged 0 to 3 years (in total 19 institutions).

Location: Urban Copenhagen

Job/tasks: Childcare

Workplace and task characteristics: Lifting, carrying and supporting children. Involves bending forward, twisting of back and sitting on floor.

Workplace participation measures: Worker focus groups used participatory ergonomics to identify and prioritise hazards and determine solutions.

The action

- **Background**

Regular tasks included in childcare work with children (0-3) consists of facilitation activities that support the cognitive and physical development of the children. It also comprises supporting, helping and assisting the children with practical tasks, such as eating, getting dressed or changing diapers.

Childcare work requires several demanding body postures and movements, such as lifting, carrying and supporting children. This means that the childcare workers often bend forward, twist their back, or sit on the floor when interacting with children. This causes high incidence of musculoskeletal pain, especially pain in the low back, neck, shoulders, knees, elbows, hands, hips and feet/ankles.

In the period leading up to the project, the internal occupational safety and health (OSH) advisors in the municipality of Copenhagen (Arbejdsmiljø København) received an increasing number of notifications regarding the work environment, high levels of sickness absence and workers reporting musculoskeletal pain from managers and OSH representatives in childcare institutions in the Copenhagen area. This was confirmed by a nationally representative survey on health and work environment indicating that childcare workers in Denmark report a great amount of physical workload, much physical exertion during work, high incidence of musculoskeletal pain and high rate of sickness absence.

This led the OSH advisors to reach out to the Danish National Research Centre for the Working Environment. Together they co-developed a participatory ergonomics intervention project to reduce risk factors for musculoskeletal pain and sickness absence and associated costs. The participatory ergonomics activities were initiated to encourage workers to get involved in optimising their own work routines to decrease work-related risk factors and improve their health.

Participants and stakeholders

In total, 96 childcare workers from eight private and public day care institutions participated in the research project. The majority (81%) of the workers were female and native Danes (90%). As part of their daily work tasks, childcare workers organise and distribute specific tasks, and initiate and implement new procedures and ideas. Childcare workers are generally characterised as dedicated to caring for children and putting children's needs before their own.

A research team designed and organised the intervention and developed a protocol describing all intervention activities. Three ergonomics consultants (occupational therapists and physiotherapists) from the municipality's internal OSH advisors presented and guided the intervention activities. Before the intervention, the researchers trained the ergonomics consultants in how to follow the protocol and carry out the intervention activities.

The childcare institutions in the municipality of Copenhagen are divided into five administrative divisions, covering all public institutions and some private institutions. Within each division, the institutions are organised into a number of groups (six to nine groups) of institutions (three to eight institutions per group). Each one has an institution group manager. The institutions are further divided into work teams. At each organisational level, the research and ergonomics teams held informational meetings, discussed the intervention and ensured managers' consent to participate at institutional levels.

Participatory approaches, methods and tools

Main principles

The participatory approach consisted of a 20-week, whole-system, participatory ergonomics intervention. During the intervention period, the ergonomics consultants invited all members of the work teams to participate in three participatory workshops held alongside regular staff meetings.

In the workshops, the childcare workers systematically carried out the following six steps:

- Identify risk factors.
- Analyse risk factors.
- Develop solutions.
- Implement prototypes.
- Evaluate prototypes.
- Adopt solutions.

The childcare workers participated in all six steps, including prioritisation and implementation of solutions.

Initial workshop

The first workshop lasted three hours and covered several procedures.

Firstly, the ergonomics consultants asked the work teams to identify and prioritise three to four work tasks that they perceived as important risks of musculoskeletal pain. The selection criteria were: a) many workers perform the task, or the task is performed many times a day, and b) the task entails either high physical workload or much physical activity. The selected work tasks were defined as core work tasks.

Next, the consultants asked workers to identify and prioritise solutions according to efficiency, feasibility and integration with the core task. To help the participants develop solutions, the ergonomics consultant presented a "prevention flower". It consisted of seven petals representing the different prevention elements that the workers needed to consider: workspace; culture, norms and values; training and knowledge; work postures and techniques; personal protective equipment; assistive devices; and organisation and planning work tasks. Each work team discussed the solutions and selected one. After this, the work team developed an action plan, specified actions and responsible persons, and carried out the actions.

Follow-up workshops

The two follow-up workshops last 1.5 hours each. The ergonomics consultants conducted the second workshop approximately six weeks after the initial workshop, and the final workshop approximately four weeks after the second workshop. At the two follow-up workshops, the work teams evaluated and

adjusted the solutions, developed a plan for how to maintain the adopted solution, and decided how to continue a process of identifying new risk factors and solutions once the intervention period ended.

- **What was achieved**

Risks and solutions

The identified hazards included lifting children up onto changing tables and into cribs, and squatting or sitting on the floor when assisting the children in getting dressed for outdoor activities. Many of the generated solutions related to making the children less dependent on active assistance from the childcare workers. This included the work teams purchasing low-cost equipment enabling children to safely climb up to a comfortable work height for the childcare worker. It also included the work teams dedicating time to teach the children to get dressed themselves, reorganising other work tasks so the schedule allowed the necessary time for the children to get dressed, and purchasing or relocating stools to the dressing areas to decrease childcare workers' time spent sitting on the floor or squatting.

Reduction in sickness absence

The researchers measured the childcare workers' self-rated physical exertion and musculoskeletal pain concerning maximal pain intensity in eight body regions (low back, neck, shoulders, knees, elbows, hands, hips, and feet or ankles), number of pain regions and pain-related work interference. In addition, the childcare workers reported being sick due to musculoskeletal pain, self-efficacy, need for recovery and workers' self-perceived level of involvement.

After 20 weeks, pain-related sickness absence was on average reduced by 0.4 days, corresponding to an impressive decrease of 88%. Despite the researchers' expectation, the intervention did not decrease the musculoskeletal pain, physical exertion, or change any other outcome measures.

Worker satisfaction

When asked, participants were satisfied overall with the intervention (78%) and found it relevant (82%). In addition, nearly all participants (92%) considered the intervention to be relevant for other childcare institutions. After implementing the intervention, 58% of the participants agreed they had finally addressed some hazardous work methods they had previously accepted.

- **Case extracts and quote**

'Many of the kindergarten teachers experienced physical pain, which made the workplace change relevant for them, as it focused on their needs.'

'The kindergarten teachers perceived the workplace change as meaningful when the solutions were closely associated with the core tasks. This is important so that the solutions at the same time were associated with the core tasks and ergonomic problems […] The workplace change effect on MSD-related sickness absence could therefore be explained by the children requiring less assistance, possibly making the childcare worker better able to work with the same level of MSD.'

'The more management participate in start-up meetings, the higher the chance of success.'

A clear distribution of roles reduces the uncertainty about who has responsibility for the different tasks. Knowing who does what means that the nursery workers can concentrate on their specific work tasks.

The external support from OSH consultants was important for the generation of solutions. If the kindergarten teachers had a hard time keeping up the motivation to implement changes, visits from the external OSH consultants increased their motivation.

Having time to have a nuanced and detailed talk with colleagues about challenges expanded the kindergarten teachers' consciousness about how to cooperate with colleagues and how to draw on each other's competencies and knowledge.

'… they can see it makes a difference. Experiencing themselves that they have less pain …'

Resources, costs and benefits

- The main intervention costs included costs for planning and conducting the workshops, costs related to childcare workers' work time spent on workshops, and implementation of changes, including purchase of new equipment.
- Costs related to the workshops covered the work time of the ergonomics consultants (including preparation time), refreshments and stationery.
- The childcare workers' involvement and activities took place entirely during work time financed by the workplace.
- Costs relating to new equipment was kept at a minimum and within the existing budget of the individual institutions.
- Costs concerning researchers' time and effort, the development of the intervention, introductory and preparatory meetings, and printed information materials were covered by a research grant.
- The benefits in terms of decreased sickness absence are considerable and expected to outweigh the costs.

Analysis

- **Barriers**
  - Lack of managerial support and involvement in the process were major barriers to implementing solutions. Higher levels of participation by the managers in the meetings led to bigger changes for success.
  - The intervention and follow-up meetings were time-consuming and took up time from other items on the agenda in the pre-planned staff meetings. The institutions had to prioritise the time for the intervention, and sometimes made compromises with other important and competing issues.
  - Some of the groups needed detailed guidance in suggesting solutions due to limited knowledge about ergonomics. Though it was a participatory intervention, the ergonomics consultants sometimes had to propose the solution to ensure that the solution would actually counteract the risk.
  - The ergonomics consultants felt that a longer follow-up period and more frequent visits from the consultants potentially could have increased the sustainability of the intervention.
  - A high use of temporary workers limited the implementation of solutions and sustainability of the changes.
- **Facilitators**
  - The most important factor for the successful implementation of this worker participation approach and the positive outcome was the close focus of the participatory elements on the workers' core tasks (caring for the children). Starting with the core tasks, workers were not only asked to identify hazards, but to also identify those they consider most hazardous, that is, where the need for changes is highest, as well as to generate solutions that are meaningful and relevant to them. This focus on the core tasks made the approach and generated solutions highly relevant to the workers.
  - Childcare workers made decisions regarding their work organisation and discussed learning strategies for the children and new initiatives on a daily basis. This pre-existing high level of autonomy in planning, organising and distributing work is conducive to the success of the participatory process because the workers were already familiar with and confident in many of the intervention activities.
  - As the intervention covered how to continue a process of identifying new risk factors and solutions in the future, this should help the long-term sustainability of the intervention.

- **Lessons learned**
  - Low-cost workshops conducted during working hours can reduce pain-related sickness absence.
  - A close relationship between the new intervention and core operations increases the participation of workers and generates better solutions.
  - The intervention can reduce pain-related sickness absence, but in the presented case not pain. This indicates that following the intervention, workers are more comfortable working despite possible pain.
- **Transferability**

The participatory intervention is directly transferable to other childcare workers in other countries, regardless of organisation size. The intervention is likely highly relevant to other sectors, provided the focus remains on the tasks selected and prioritised by workers. Training workers in participatory procedures may be needed if workers are not accustomed to involvement in decisions regarding daily operations.

References and further information

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- **Scientific publications**

Rasmussen, C. D. N., Hendriksen, P. R., Svendsen, M. J., Ekner, D., Hansen, K., Sørensen, O. H., ... & Holtermann, A. (2018). Improving work for the body–a participatory ergonomic intervention aiming at reducing physical exertion and musculoskeletal pain among childcare workers (the TOY-project): study protocol for a wait-list cluster-randomized controlled trial. *Trials*, *19*(1), 1-14.

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In addition, the case description builds on three interviews with the ergonomics consultants and the lead researcher on the project.

4.5 Case 3 - Participatory workshops with female food preparation workers to find solutions to musculoskeletal problems

General information

Country: Finland

Sector: Hotels and catering

Type of organisation: Multiple public sector canteens or kitchens

Size of organisation: Medium

Location: Urban

Job/tasks: Various tasks related to food preparation

Workplace and task characteristics: Awkward movements, postures and loads, and repetitive movements involved in food preparation tasks. At the beginning of the study, 70% of the workers reported that they had suffered from pain in neck and shoulders within the previous three months.

Workplace participation measures:

- Pre-intervention workshops to provide training in analysing tasks and identifying hazards.
- Onsite analysis of work problems by the workers.
- Intervention workshops to examine solutions.
- Risk analysis by workers (following training).
- Questionnaires to assess stress.

The action

Background

The Finnish Institute of Occupational Health decided to carry out a study to see if ergonomic improvements based on worker participation could decrease the high incidence of musculoskeletal disorders (MSDs) and related sick leave among this group of workers. The study was carried out in kitchens because the work exposes workers to various types of physical workloads. Finland has a strong tradition of worker participation in occupational safety and health (Perttula, 2013), where there is strong cooperation between workers and management.

Participants and stakeholders

The study involved 119 municipal kitchens and 504 mainly female workers. The project was carried out by an external expert from the Finnish Institute of Occupational Health. Only half the kitchens took part in the intervention; the other half continued to carry out their work in the usual way.

Participatory approaches, methods and tools

The workers themselves identified hazards, analysed designed solutions to the problems and implemented changes.

Pre-intervention workshops and activities

Before the start of the intervention, the workers participated in two workshops and carried out activities in the intervening time. Both workshops lasted five hours. During the workshops, the workers were taught to analyse their work with the aid of an external expert.

During the first workshop, they chose between one and four work tasks that caused most strain to the workers. Analysis of these work tasks started.

Workers continued analysing their work tasks during the one-month period between the two workshops. At this period, the researcher (external expert) visited each kitchen once and contacted the kitchens once by telephone to ensure that the task was understood and that workers were able to perform the analysis.

The second workshop consisted of continuing the analysis, choosing the development points to be carried out in practice and developing a timetable.

Intervention

The intervention began after the second workshop and lasted for 9-12 months. The workers filled in questionnaires every three months during this time.

Four more workshops were held (one every fifth week). The workshops were held in different kitchens each time, giving the workers the opportunity to familiarised themselves with other kitchens. In each workshop, progress on the development was discussed and different solutions to the problems were examined.

The workers estimated the stress levels associated with their work tasks and frequency and duration of such tasks through the questionnaire. They answered questions on relevant psychosocial factors every third month. The risk factors were observed at the beginning of the study by the researchers.

The study progress was guided and supervised by a control group consisting of financiers, union representatives and officials responsible for catering safety and health in the cities concerned.

- **What was achieved**

In the intervention kitchens, 402 changes were made. At the same period, 80 changes were made in the kitchens that did not take part in the intervention. The workers' experience was that the musculoskeletal symptoms had decreased because of the changes in ergonomics. It is possible that at the beginning of the intervention, the workers became more conscious of ergonomics and probably also began to pay more attention to their MSDs.

- **Case extract**

During the first workshop, they [the kitchen workers] chose between one and four work tasks that caused them the most strain, and an analysis of these work tasks began.

Four workshops were held (one every fifth week) in different kitchens each time, giving the workers opportunities to familiarise themselves with other kitchens. In each workshop, progress on the development was discussed, and different solutions to the problems were examined and compared. Workers considered this to be a critical success factor.

Analysis

- **Facilitators**

The best results can be obtained by cooperation between workers and management.

  - Workers considered that being able to learn from the practices in other kitchens was a success factor.
  - Participating in the workshops improved the cooperation both in workers' own kitchens and between different kitchens.

The intervention involved both analysis of physical risks and self-assessment of worker stress.

- **Transferability**

This type of intervention can be transferred to other individual workplaces where the need to improve ergonomics is an issue. Similar methods for improving ergonomics could be carried out in various workplaces, beginning with the questionnaire and its analysis and workshops. However, an external specialist is needed to guide the process.

References and further information

The information on this case was compiled by EU-OSHA. No additional written material is available.

Perttula, P. (2013). OSHWiki: *Worker participation – Finland*. Retrieved 30 June 2021, from https://oshwiki.eu/wiki/Worker_participation_-_Finland

Riihimäki, H. (2008). *Ergonomiaintervention vaikuttavuus -satunnaistettu kontrolloitu tutkimus.* Työterveyslaitos, Helsinki, Joulukuu. Available at: https://docplayer.fi/6307821-Ergonomiaintervention-vaikuttavuus-satunnaistettu-kontrolloitu-tutkimus.html

4.6 Case 4 - Using the TMS Pro participatory approach to reduce musculoskeletal disorders for packaging line operators in agribusiness

General information

Country: France

Sector: Agribusiness

Type of organisation: Provincial authority

Size of organisation: Factory belonging to an international group

Location: Rural

Job/tasks: Finished product packing and packaging line operators

Workplace and task characteristics: Handling heavy loads, repetitiveness and awkward postures.

Workplace participation measures: Implement a project to prevent stress and strain as part of a Carsat TMS([1]) Pro and Health and Performance programme.

The action

▪ Background

Project start-up

In 2014, the factory's human resources (HR) manager noted an increase in accidents at work and occupational illness. This happened despite a certain number of preventive and corrective actions set up by management, such as recruitment of a health, safety and environment manager and training team leaders in the prevention of occupational risks. Furthermore, a process for introducing automation had been taking place for several years. The number of musculoskeletal disorder (MSD) cases affecting the carpal tunnel, back and shoulders was extremely high (over 1,800 days of absence from work between 2014 and 2015). The factory's workforce was ageing (average age 44), and many employees had been working at the factory for a long time (20 years on average). The operators suffered from pre-existing musculoskeletal problems.

The factory was selected to be part of the TMS Pro programme in conjunction to the Carsat Rhône-Alpes Health and Performance programme. A Carsat referral officer guided the factory as it applied the TMS Pro approach, and an ergonomist was contracted to help roll out the project through the Health and Performance programme.

In the agribusiness sector, this programme organises sector seminars with several companies in the same industry. The programme provides participants with the opportunity to share their experiences and prevention practices. The company's health, safety and environment (HSE) manager and HR manager participated in these meetings with representatives from 10 other companies.

The implementation of both programmes between 2014 and 2018 helped the company to set up a lasting occupational safety and health (OSH) policy which they could manage on their own.

Prevention culture

In terms of OSH, the company's management set objectives every six months based on indicators defined and shared with the production teams. However, the managers emphasised that the prevention culture had not been appropriately communicated and that the oldest workers were the least inclined to apply the policy. To instigate a change, the new HSE manager, working closely with the HR manager, occupational nurse and design office, set up actions involving the employees.

Participatory culture

The company had always insisted on employees participating in the improvement of working conditions. Before the TMS Pro approach was introduced, the operators had already been invited to provide input twice a year in team workshops that reported problems, defined improvement possibilities and developed shared objectives for the next six months. Alongside these meetings, seminars were organised twice a year with different managers and top management to discuss feedback from the field and establish a common vision of priorities for safety and health. All worker feedback was considered and taken into account by management. Management organised inter-team meetings when a modification concerned several production lines. When the change involved a large project (change in packing, transformation of a line, change in production), a project group and action plan were set up. Before the project was introduced, the production engineering manager ran the project with the line manager.

Again, previously, when a new line was designed or a new machine purchased, only the line technicians concerned were consulted. Top management's policy of including the opinion of the operators was not followed by all the managers.

An ergonomic packing line was designed before the start of the project. This line was the reproduction of a packing line developed on another site designed with the help of an external company and based

([1]) TMS means MSDs in French

on a biomechanical analysis of stress and strain. Some manual tasks were automated, but the resulting line design proved to be more exhausting, especially for packing in boxes.

- **Participants and stakeholders**

Volunteer employees participated in the project, especially during the solution development phase.

The HSE manager, who had taken up this position before the start of the project, but had worked in the company for over 30 years, coordinated and led the project, working closely with the HR manager.

Carsat, a French organisation specialising in occupational health and prevention, targeted the factory site in Charancieu for its TMS Pro and Health and Performance programmes. The Carsat officer appointed to the site made sure the project was properly carried out in the company by being present during key stages for meetings with the safety and health committee or with the project coordinators.

The site director facilitated the project's roll-out by providing the workers with the means to participate, including time to take part in meetings, working groups and tests, and to allocate financial resources. A consultant ergonomist supported the company during the phase where work situations identified as exhausting were analysed. The occupational nurse, who had been recruited at the start of the project, was a member of the steering committee. The safety and health committee was called on and became strongly involved in the roll-out. Its secretary was a member of the steering committee.

- **Participatory approaches, methods and tools**

The TMS Pro approach is divided into four steps.

Step 1: engage in the approach and provide an overview of the situation

The HSE manager organised about 20 meetings with the line managers and workers to inform them about the project. These meetings provided the opportunity to ask the participating workers about what they wished to improve.

A steering committee was quickly set up with the site manager, HR manager, HSE manager, secretary of the safety and health committee and the occupational nurse.

Step 2: formally introduce the MSD prevention project and identify priority work situations

The HSE manager, HR manager and occupational nurse compared data on lost time with the site's work situations. This allowed them to determine which workstations should be analysed as a priority. The safety and health committee was informed of the results and liaised with the operators. A packing line that had been recently transformed was selected for a more in-depth analysis of the work tasks and risks to workers.

Step 3: analyse the situation with the highest risk concerning MSDs and define a concrete action plan

An ergonomics consultant funded by the Health and Performance programme was involved in this phase to establish a diagnosis of the identified situations (end 2015 to start 2016). Top management informed other managers, the safety and health committee, the works council and the production teams about the ergonomist's role.

Working with the HSE manager and HR manager, the ergonomist prepared a map of tasks causing the most stress and strain in the workshop based on easy-to-use machine safety standards. He used photos of operators in different work situations to illustrate problems. The operators did not participate in this step.

The results were presented to the HSE manager, HR manager, concerned line managers and the steering committee. This presentation provided an opportunity to bring together the different views of stress and strain in the workshop. The ergonomist then set up working groups with the concerned line operators. The working group for the future line boxing workstation consisted of the line manager, line product technician, management technician, six packing supervisors and the HSE manager.

The working group's meetings were placed between the morning shift and the afternoon shift to include as many operators as possible. The production line operated on normal conditions most of the time, but had to be stopped a few times where the participating operators were taken out of production. The group focused on discussing what to change in the packing line.

At the end of February 2016, the ergonomist presented the results of this stage at a steering committee meeting in which representatives from the safety and health committee and the works council also participated.

Based on the ergonomist's work, the group then made a life-size scale model of the future packing line using available furniture and boxes. The HSE manager ran work simulations on the model packing line with a panel of representative operators in terms of anthropometrics, age and experience. During the simulation, the technicians were not present so that the discussions about difficulties and the search for solutions could be more independent. One after the other, each operator tried out the model packing line. They all gave their opinions about what was good and what was not, and what could be improved. They were allowed to handle or move the boxes and furniture. Nothing was said about an operator's ideas to the next operator. At the end of the day, there was a wrap-up session with all the employees to present the ideas and validate together the specification needs. These were then sent to the design office affiliated with the company's head office.

This simulation work was carried out entirely independently without the presence of the ergonomist or the Carsat referral officer.

The future workstation plan was prepared by the design office so that it could be validated by the working group in March or April 2016.

Step 4: assess prevention approach

When the new packing line had been mechanically set up in September 2016, the working group was brought together again and included the in-house ergonomist. They assessed the workstation and looked for aspects to be improved before the line was started up again in June 2017. The HSE manager performed an additional assessment with the operators when the new line was set up and ready to operate.

As part of the new worker integration plan, several discussions were organised during the initial months. The new workers discussed their activity and working conditions with their supervisor, the line manager and the product technician. This was an opportunity to collect the new workers' opinions about the line and identify potential problems.

In this way, the participatory approach was applied by the company when hiring new workers, too. However, some managers were reluctant to accept this new approach, and company management had to continue to promote the approach to managers during formal and informal discussions.

The operators followed training on movements and postures. An important part of the training took place at the workstation to assess how the operator could adopt postures that create the least stress and strain. If less exhausting postures could not be found, the problem was noted and included in future line developments, such as the purchase of a new machine.

The new workers' supervisors were trained to look for prevention possibilities and promote occupational health and workstation safety to learners.

Safety behaviour tours were organised regularly by trained volunteer employees. These employees observed other colleagues, providing them with feedback about identified problems, for example adopted postures, ways of doing things and safety instructions. They then talked about the causes of problems and possible remedial measures to be implemented.

- **What was achieved**

Participatory approach

Regarding the participatory approach, the following was achieved:

- The company continues to apply the approach on its own.
- The HSE manager, HR manager and members of the safety and health committee spend one day every two to three weeks on OSH activities, such as reviewing projects under way, establishing cause trees after occupational incidents or accidents and touring the workshop. The safety and health committee is encouraged to coordinate projects with the production teams on the shop floor.
- The project organisation has been reviewed: now it is line managers who coordinate projects so that the production workers can more easily be included as stakeholders. Following the

recruitment of an ergonomist in 2018, the production engineers were trained to pay attention to ergonomics and therefore adopt a more ergonomic approach to technology projects.

- New lines are currently being transformed. The factory is applying the same method used for the packing line, with the support of the in-house ergonomist. Safety reviews are organised every week with the workers, line managers and assistants. The discussions often lead to easy-to-implement solutions that facilitate the work.
- When new equipment is bought, the concerned operators are involved in the choice by testing one or several models. These tests lead to specifications being prepared for the purchase. The HSE manager asks the operators to assess the equipment after it is bought.
- The site's prevention officers use ergonomists' techniques (photos, videos) to discuss work with the workers.

Improvements

- Regarding the packing line, the project received some very positive biomechanical feedback. The operators reported feeling less tired and additional handling assistance equipment has been purchased.
- The number of MSD reports dropped. While nine reports were filed in 2014, only four were filed in 2019 and none in 2020. The yearly average number of days off work for occupational illness has decreased by 40%. Between 2014 and 2016, there was a yearly average of 957 occupational sick leave days, compared with only 378 between 2018 and 2020.
- Following the intervention, the working conditions assessment with the employees is not only based on technical indicators, but also on wellbeing indicators.

Consequences of automation

Automation divided the operators. Only one or two operators are now required to control the process. The workers have always been expected to cover several workstations, and the introduction of automation and its associated psychosocial risks reinforced this trend. Being able to switch workstations means that the operators adopt different movements and postures and work with other people. Most are happy to switch workstations. For those who are more reluctant to do so, management suggests they spend a day testing a new workstation. At the same time, the prevention officers focus on communication and support to promote the benefits of versatility.

- **Case extract**

A working group with worker representatives was assembled to validate a new production line and look for points to be improved before the line was started up. The result of the workers' participation in the implementation process reinforced their commitment to the new workplace changes.

The middle and top management held biannual workshops to get worker feedback and establish a common vision for health and safety issues.

The ergonomist gave the company the means to run and implement their existing approach. His involvement changed the way the company viewed stress and strain analysis.

The time given to workers to participate in working groups and the steering committee allowed good participation of everyone in the projects. The financial resources allocated to automation were important, the objective being the preservation of health. Health figures have been improving in recent years.

Solution generation workshops with workers were held in different workplaces, which gave workers the opportunity to see how others have managed MSD prevention.

Resources, costs and benefits

- Time to participate in working groups, steering committee and other activities.
- Substantial financial resources available, especially for new equipment or for new manufacturing line design.
- The amount of time that the ergonomist, nurse and HR manager dedicated to the intervention.
- The HSE manager emphasises that the overall cost must not be a barrier, and that it is more important to think about the future results in terms of health protection.

Analysis

- **Barriers**
  - Difficulty convincing some managers to accept the participatory culture.
  - Ageing population is not necessarily interested in the new possibilities.
  - Automation can lead to a loss of the community experience.
- **Facilitators**
  - The Carsat referral officer made it possible to organise discussions with the workers and guide the company through the project so that each TMS Pro step could be validated.
  - The ergonomist gave the company the means to develop their existing approach, especially tools for risk assessment and work activity analysis. His involvement changed the way the company viewed stress and strain analysis.
  - The driving force of management and the dynamic outlook of the safety and health committee with worker representatives contributed to the project's success.
  - The inter-company approach in which company members were involved with other companies encouraged thinking about practices and generated ideas.
  - All company levels were involved in project implementation.
  - The project benefitted from the resource formed by the HR manager and HSE manager combination. This meant that the project did not depend on a single person and that it was managed in a multidisciplinary way.
  - The management welcomed feedback from the shop floor without any questioning and initiated concrete action plans with worker follow-up.
  - The technical view of the HSE manager (who had formerly worked in production engineering) substantially evolved over the course of the project: he was able to foster participation thanks to his technical knowledge.
  - The management committee has not changed since 2016, which is rare in the agribusiness sector.
  - There is a certain sense of wellbeing in the company. The workers feel united (managers and operators).
- **Innovative features**

Innovative features of the intervention include the following:

- The factory organises frequent discussions about work with the employees (weekly safety reviews, biannual meetings, safety behaviour tours, training, seminars). The resulting feedback is processed and actions are implemented. This creates a climate of trust among the employees and managers.
- The management team encourages the safety and health committee to carry out projects to improve working conditions.
- Line managers lead projects to transform their line instead of engineers.

- **Lessons learned**

Despite the management team's determination to protect health and consider the workers' point of view, the number of work accidents and occupational diseases kept increasing before the approach was

introduced. The guidance provided by both the Carsat referral officer and the ergonomist provided the company with the means to improve their existing approach by encouraging them to consider real working conditions. Following the intervention, the factory is able to run its prevention policy without any outside help.

- **Transferability**
  - The TMS Pro approach can be implemented in any business sector.
  - In France, financial aid is provided to companies with fewer than 50 employees. This aid is intended to support the purchase of equipment or the provision of services, such as training and diagnostics. With this external support, the TMS Pro approach is also relevant for micro and small enterprises.
  - Many resources are available in French, such as a sample dashboard, MSD risk assessment grids and prevention approach assessment grids.
  - Inter-company work meetings encourage practices and foster knowledge about implementing a participatory approach to prevent MSD that can be shared.

References and further information

Assurance Maladie (2021). *TMS pros: une démarche efficace en 4 étapes.* Available at: https://www.ameli.fr/entreprise/sante-travail/risques/troubles-musculosquelettiques-tms/demarche-tms-pros?gclid=CjwKCAjwqcKFBhAhEiwAfEr7zZrZ9R17gbnOj20dqx7MwlSZBxGpxCKwUiU-eWahUGGAbfidiryn8RoC_AEQAvD_BwE&gclsrc=aw.ds

Graveling, R. and Giagloglou, E. (2020). *France: The TMS Pros programme and other initiatives to tackle MSDs*. EU-OSHA – European Agency for Safety and Health at Work. Retrieved 20 August 2021, from https://osha.europa.eu/en/publications/france-tms-pros-programme-and-other-initiatives-tackle-msds/view

Video of companies having implemented the TMS Pro approach (in French):

Assurance Maladie (2018). *Trophées TMS Pros 2018, Lauréat catégorie « Plus de 200 salariés »: Brioches Pasquier Charancieu* [Video file]. Available at: https://youtu.be/0l3QjBDpiTE

Assurance Maladie (2016). *Trophées TMS Pros* prix spécial du jury: Socomec à Benfeld [Video file]. Available at: https://www.youtube.com/watch?v=wDPAzM2oNVc

Entreprendre Ensemble (2020). *La démarche de prévention chez Chantelle* [Video file]. Available at: https://youtu.be/Y2O-Ox9VSyE

Interviews

In addition, the case builds on five interviews with project stakeholders:

- two technicians of the designed line (members of the safety and health committee during the project);
- HSE manager;
- HR manager;
- Carsat referral officer;
- consultant ergonomist.

A half-day company visit was organised with two researchers, two technicians, the HR manager and the Carsat officer. The collective discussion about and observation of production lines and the transformed workstation completed the interview data.

4.7 Case 5 - Improving equipment by involving workers to prevent manual handling risks in a PVC plant

General information

Country: France

Sector: Manufacturing (PVC products)

Type of organisation: Multinational

Size of organisation: 129 workers at the intervention site

Location: Urban

Job/tasks: Carrying 6-metre PVC planks and dragging loaded containers

Workplace and task characteristics: Manual handling of awkward loads that had to be lifted above the head, dragging loaded containers. The tasks always involved using the same body parts.

Workplace participation measures:

- Use participation to make modifications to solve problems with work equipment.
- Involve workers in elaborating an action plan regarding risk prevention.
- Brainstorm with workers to adapt, change and improve their work equipment.
- Set up working groups. Invite workers to fill in suggestion sheets.

The action

- **Background**

The company is a very large PVC manufacturer. It supplies industrial fitters, suppliers and large do-it-yourself stores, as well as around 100 franchised PVC stockists.

The intervention took place at a plant that employed 129 workers. This plant produces PVC profiles. These are 6-m-long planks that are used for doors, windows, or shutters. The PVC profiles are produced by 28 extruders and treated to give them a better feel. This process is almost fully automated, and production is carried out 24 hours a day, nearly all year round. At the end of the production line, workers must load pieces into pallets to be sent to clients. It is at this stage that the workers were at risk of musculoskeletal disorders (MSDs). The workers had to collect the profiles, lift them above their heads and place them in a container. When a container was full, the workers moved it by dragging to allow the forklift operator to pick it up and drive it to the warehouse. Each worker was responsible for three extruder machines. They had to come and go between the extruders, following the rhythm of the process. The tasks always involved using the same body parts.

- **Participants and stakeholders**

The intervention involved the plant workers, management, especially the plant's industrial director, members of the safety and health committee and the regional health insurance fund.

- **Participatory approaches, methods and tools**

Framework for participation

Continuous improvement and autonomous work teams

The plant's industrial director was committed to the idea that work should be organised so that it is continually improving through innovation. This approach involved pragmatism and trust in those doing the work.

The way the plant operated had been overhauled using small working groups that looked at particular themes and prepared action plans. The plant was reorganised into teams of 18, each led by a supervisor. These independent teams were given complete freedom to pursue their production targets by continuously improving the equipment and their working conditions. If an idea was suitable, it was implemented immediately. The plant awarded the best innovations.

Safety and health committee

Required in all businesses with at least 50 workers, the committee's goal is to promote safety and health at work and improve working conditions. The committee includes a worker representative. It has a number of means at its disposal to fulfil its goals (information, consultation of experts), and worker representatives are permitted time off work to carry out safety duties. These representatives are typically protected from being made redundant.

Suggestion sheets and questionnaires

Workers can fill in suggestion sheets, available in the staff room, to give their ideas for improving on-site working conditions. Safety and health committee members and management examine the suggestions to assess the order of urgency and relevance. The committee receives about 300 suggestions a year. The forms can be submitted anonymously.

Annual performance review targets

During the annual performance reviews, individual workers are also given targets for the year ahead related to improving working conditions.

Equipment modifications to avoid manual handling

One team of workers adapted a machine to avoid having to carry products manually. The machine is an extruder with considerable upgrades installed. To reduce manual handling, the company had previously installed a fully automated robot to carry the profiles to the containers aided by suction pads placed on either side of and above the PVC profiles. However, that system was not secure. If the alignment was not perfect, the pads did not grip the profiles properly and they fell off. Two operators had their fingers crushed because of this.

There was a need to avoid the risks posed by the fully automated machine, and at the same time to avoid the risk of MSDs for the workers doing the manual handling. In all, 90 manual workers assigned to the production facility were involved in this task. Certain profiles weigh three kilograms (kg) per metre each, and every worker was handling on average about 3,600 kg a day.

When discussing measures to reduce this load safely, the company director wanted to hear contributions from all sides, convinced that everyone involved had something to contribute to improving working conditions. The company formed working groups to improve the situation. Alongside the maintenance service, the warehouse teams prepared a list of the most painful movements they are required to make while using the machine. Improvements were gradually made. The workers regularly presented ideas based on their experiences in using the equipment.

The safety and health committee and the regional health insurance fund supervised every stage.

- **What was achieved**

Initially, the container was replaced so that the profiles fell directly into it. However, back problems persisted. It was still necessary to stoop to align the profiles in the base of the tray. Therefore, it was suggested that the base of the container should be made detachable to collect the profiles at shoulder height. One idea led to another, and the packing table was equipped with downward-facing guide bars. The profiles could then slide more easily into the container.

Finally, the working group considered placing the container on a wheeled trolley to make it easier to move. Pulling a standard container requires traction of about 220 kg, compared with 80 kg for the new wheeled system. The working group also positioned operators five centimetres closer to the exit table, making it easier for them to catch any profile that does not fall properly.

- **Case extract**

The plant's industrial director was committed to the idea that work should be organised to create continuous improvement through innovation. This approach involved pragmatism and a trust in those doing the work. The company philosophy involves continuous work improvement and trusting those on the ground doing the work.

The spirit of innovation seen with this group of workers spread to other production lines.

If an idea was suitable, it was implemented immediately ... [Other] improvements were made gradually, looking at different potential paths and amending things that did not work. The aim was to produce a machine that, by the end of the process, responded perfectly to risk prevention and comfortable use criteria set by users.

Resources, costs and benefits

Support was offered by the Regional Health Insurance Fund. Seven new machines were introduced at a cost of EUR 13,000 per device. The head office also decided that when any new production lines were introduced, they would be equipped with these new machines. However, not every production line could benefit from this system. Four others made small pieces or very flat profiles that required a different manufacturing process and had to be perfectly aligned with containers. No immediate solution to this was found. However, the spirit of innovation seen with the first group of workers spread to other production lines and they will continue to look for solutions.

Analysis

- **Barriers**

No major problems were encountered.

- **Facilitators**
  - A company philosophy of continuous work improvement and trusting those on the ground doing the work.
  - The company already had in place a system with various components for worker participation in improving working conditions.
  - The reorganisation of the production line and establishing autonomous working groups in this area created a promising framework for workers to take the initiative in their working conditions.
  - Improvements were made gradually, looking at different potential paths and amending things that did not work. The result was a machine that, by the end of the process, responded perfectly to the risk prevention and comfortable use criteria set by users.
  - The involvement of management was fundamental as the manager encouraged workers to present their ideas for improvement.
- **Transferability**

While this is a large company, the basic principle that workers should be involved in continuously improving their work and prioritising workers' ideas to improve work equipment can be applied to any industry or sector.

References and further information

The information on this case was compiled by EU-OSHA. No additional written material is available.

Clergiot, J. (2010). *Travail & Sécurité: La prévention passe par les travailleurs.* Retrieved 15 July 2021, from https://www.travail-et-securite.fr/dms/ts/ArticleTS/TS-TS711page34/TS711page34.pdf

4.8 Case 6 - Training hotel service workers as prevention coordinators to work with colleagues to prevent musculoskeletal disorders

General information

Country: France

Sector: Hotels and similar types of accommodation

Type of organisation: Hotel

Size of organisation: Medium

Location: Urban

Job/tasks: Hotel cleaners, linen keepers, catering staff

Workplace and task characteristics: Awkward movements, posture and loads involved in pushing and pulling heavy linen trolleys, bending to make beds, and using shoulders and wrists to clean mirrors and tiles. Many of the hotel staff were classified as having a musculoskeletal disorder (MSD) due to their work.

Workplace participation measures:

- Prevention coordinators selected by the workers and then trained.
- Prevention coordinators discuss problems with the co-workers.
- Staff surveys and other communication methods used with all the workers.

The action

- **Background**

The work of hotel cleaners, linen staff and catering staff involves awkward movements and posture, repetitive movements and moving heavy loads. Many of the hotel's staff suffered from MSD because of their work, and there was an urgent need for preventive action.

The new hotel director already had prior experience from another hotel in implementing a working group that allowed hotel cleaners to participate in a critical analysis of their daily tasks and to make proposals for improving working conditions. He decided to do the same at his new workplace. The hotel director contacted the Regional Health Insurance Fund for support. The insurance fund proposed a method of training worker volunteers as prevention coordinators who would then involve other workers in prevention. The insurance fund's aim was to provide businesses with internal competencies, relying only on themselves to diagnose and analyse risky situations and find the most appropriate solutions.

- **Participants and stakeholders**

The intervention involved the Regional Health Insurance Fund as training provider. Volunteers were chosen by the workers to become prevention coordinators and then they involved the whole workforce.

- **Participatory approaches, methods and tools**

Roles and training of the prevention coordinators

Six staff members (hotel cleaners, linen keepers, catering staff) were selected by the workers to serve as prevention coordinators. Following training, they undertook a group project to examine the work of hotel cleaners, linen keepers and catering staff.

The volunteers completed two days of method training led by the Regional Health Insurance Fund. They then observed and analysed real-life working conditions, followed by a day dedicated to producing a feedback report. They studied the work circumstances and considered how appropriate the solutions being applied are.

The group's task was also to communicate information on safety and health at work to the other hotel workers. The training did not include a specific focus on communication with co-workers, but it provided tools for them to raise awareness among co-workers. The six workers chosen to undertake training were mainly workers who had already been trained as in-house trainers.

The prevention coordinators were very familiar with the jobs they were examining and were in a position to make relevant remarks on potential solutions. By looking at the work from a different perspective through observation and exchange of information with co-workers, they analysed problematic day-to-day activities to find useful solutions.

Time was set aside during the working day for the prevention coordinators to observe the work circumstances and to discuss them with co-workers. They were also able to film or take photos to illustrate their observations. They were provided with resources (a room, IT equipment, cameras to film working situations), as well as time off from their other duties (six and a half days during the intervention year, apart from training).

A report was produced that made several proposals. The human resources (HR) department followed up on these proposals according to the time needed to implement them.

Involving other workers

To inform the 240 employees, the HR department used the following channels:

- internal communication tools (including memos to staff, poster campaigns, a newsletter and a staff forum four times a year);
- creation and dissemination of specific tools for employees (prevention booklets);
- training for workers, initiated by the company, on stress prevention and development of wellbeing at work (intended for all workers), or on preventing risks from manually handling loads risk and manually handling loads;
- opportunity for workers to provide information or comments in the annual work satisfaction survey.

- **What was achieved**

Hotel cleaners

Following the feedback given by the hotel cleaners, telescopic dusters and raised beds were installed in two test rooms at the hotel to make their work easier. A housekeeping manager and prevention coordinator were sent to the director's previous hotel where such equipment was already in use to compare the teams' experiences. On each floor, a network of workers was formed and cooperation among the cleaners was encouraged. The exchanges were productive. If these tests proved positive, the plan was to install the equipment in other rooms, following any adaptations if necessary.

In parallel, hotel cleaners were offered the opportunity to gain a professional qualification certificate that included training in professional risk prevention and a briefing on managing pain at work. This training was made available to all hotel cleaners, not just the prevention coordinators. The training improved the hotel cleaners' employability. This is important because they do a difficult job that does not offer many opportunities for career advancement.

External catering staff

Catering staff from external providers often work in the hotel. In collaboration with the suppliers, the hotel provided training for the external providers. The training included an exercise aimed at listening to workers and anticipating potential problems.

Linen keepers

Furthermore, hotel management considered improving working conditions for linen keepers who have a physically demanding job. They were encouraged to speak freely about their problems, and the obstacles and difficulties they face. One issue was the linen trolleys. Even when not very busy, the linen staff completed 16 trips a day with the trolleys. At peak times, that number tripled. Pushing a trolley full of damp linen at arm's length is heavy work, so much so that the wheels have difficulty moving on the carpet.

Equipment from another establishment to make pushing the linen trolleys easier was adapted by the supplier specifically for the hotel.

A customised single part links the linen trolley to the bar used to push it. All that is necessary to attach it to the trolley is to centre it. Staff received one hour of training on how to use the equipment. This is important because, before the training, the linen staff tended to pull the trolley, even though the simple push of a button would make it move forward.

Even in awkward corridors, the adapted trolley became manoeuvrable. The new equipment made the job much easier. The participative nature of the process helped introduce the equipment and achieve staff satisfaction.

Impact on MSDs

In the year following the intervention, there was a 7% decrease in the number of working days lost. The project created a forum for sharing problems and simple methods to improve working conditions. It changed the perspectives on work and the way it was organised. An improvement in communication within the organisation was observed, and the prevention coordinator approach was extended to other services, such as baggage and dishwashing. The staff felt that they had a voice and their problems and ideas were acknowledged.

There are plans to involve the prevention coordinators in broader organisational activities, including a planned renovation.

The hotel won an award for MSD prevention from the Regional Health Insurance Fund.

- **Case extract**

Hotel management considered staff health and safety as important as guest comfort.

The project created a forum for sharing problems and simple methods to improve working conditions. It changed the perspectives on work and the way it was organised.

The expertise and support of the Regional Health Insurance Fund were crucial. The insurance fund proposed a method of training worker volunteers as prevention coordinators who would then involve other workers in prevention. The fund's aim was to provide businesses with internal competencies, relying only on themselves to diagnose and analyse risky situations and find the most appropriate solutions.

Resources, costs and benefits

Support for training was offered by the Regional Health Insurance Fund. The volunteers received time off work for the training. The hotel also provided some training to external providers to engage them as well. The subsequent intervention took place during working hours. The hotel financed the purchase of new equipment, including a customised linen trolley. Improvements in sickness absence outweighed the costs in terms of staff time and new equipment.

Analysis

- **Barriers**

No major problems were encountered.

- **Facilitators**
  - Staff health and safety is considered as important as guest comfort.
  - The involvement of all workers in prevention is freely encouraged. They feel that they have a voice and their problems and ideas are acknowledged.
  - The prevention coordinators got their colleagues involved. They required training in this specific role, and were provided with training, time off and resources.

- The approach of using prevention coordinators who then work with their colleagues makes it easier to involve workers. In particular, it enables workers to raise problems and propose solutions, which can then be discussed among the colleagues and the prevention coordinator.
- The improved linen trolley showed the importance of not only having the right equipment, but also training workers in its use.
- The expertise and support of the Regional Health Insurance Fund were crucial.

The MSD intervention was part of a wider commitment to staff participation in safety and health and the hotel's commitment to staff, such as involving them in a renovation project and offering career training for hotel cleaners.

- **Lessons learned**
  - Training key workers that know the job and who then inform fellow workers can be an effective way of involving the entire workforce.
  - Training key workers in analysing risk and identifying solutions can reduce the organisation's need to use external consultants.
  - The involvement of all workers can improve communication overall in an organisation.
- **Transferability**

This approach is transferable to other services, hotels and sectors. However, the organisation would likely need assistance from a prevention organisation to train prevention coordinators and support them in their examination, as well as to apply the prevention solutions. In smaller organisations, it would be possible to have just one or two workers trained in the coordinator role.

References and further information

The information on this case was compiled by EU-OSHA. No additional written material is available.

4.9 Case 7 - Reducing musculoskeletal disorders of viticulture workers through a participatory approach involving video analysis

General information

Country: France

Sector: Viticulture (agriculture sector)

Type of organisation: Vineyard, activities include grape growing, wine production and packaging

Size of organisation: Micro enterprise (less than 20 workers)

Location: Rural

Job/tasks: Prune grapevines

Workplace and task characteristics: Bending, squatting, repetitive movements, awkward postures.

Workplace participation measures:

- Technical analysis is combined with worker participation.
- Working party of workers provided continuous feedback to consultants.
- Workers involved in evaluating observational videos.
- Volunteer workers tested the proposed solution.

The action

▪ Background

The viticulture industry is characterised by a high level of musculoskeletal disorders (MSDs). They affected the company so much that absenteeism reached 50% during the grapevine pruning season. The workforce mainly consisted of ageing workers because the company had difficulty hiring younger workers. The company contacted the Regional Health Insurance Fund, which made an initial assessment and proposed using a system that analysed videos of workers tackling MSD risks.

▪ Participants and stakeholders

The intervention involved ergonomics experts from the Regional Health Insurance Fund, the company and the workers. The external ergonomics experts used a video analysis system to assess MSD risks of workers carrying out their work on site combined with worker participation.

▪ Participatory approaches, methods and tools

Planning the intervention

To plan the intervention, the Regional Health Insurance Fund experts held two meetings, one with the managing director and one with the workers. During the meeting with the managing director, the ergonomics experts examined the work situation and the aim of the intervention.

The meeting with the workers was used to explain the intervention's aim and what was going to be done. The ergonomics experts explained that after an analysis of the situation to gain insight into their activities, they would film and work with them in the form of a working party. An important aspect of the meeting was to explain to the workers that the consultants were impartial and ready to listen to them. They explained that the results would remain anonymous and not be given to the company.

Setting up the working party

A working party of workers was set up and used throughout the process in various ways. As this is a small company, it included the workers and the managing director. They were involved in validating the video analysis, testing solutions and deciding how the final solution would be implemented. The ergonomics experts provided MSD training to working party members to raise awareness and help them understand the link between job activities and MSDs. He also outlined various possible solutions.

Filming the workers

The consultants studied the company's workstations to determine which work situation was the most relevant for filming and analysis. Many details were considered. They included, among others, the analysis of the work situation in both favourable and poor conditions, the different modes of operation and the different characteristics that could affect the way the workers do their job.

Analysing the film

The video of the work situation (see section 2.4.4) was then imported into a video analysis system. The postures and their angles were scored according to a guide based on established ergonomic criteria. The biomechanical characteristics, the factors that worsened the condition and the exposure time were all considered in the analysis.

The working party then validated the results of the video analysis to check that they were consistent with the real situation and the opinions of the workers, particularly the effort needed to do a particular task. Considering members' feelings about and experience in performing the work, the working party gave its view on the expert ergonomists' scores concerning working postures and their angles. Once the scores were agreed on, the group validated the representation of the work situation by the consultant. This is important because each worker may be performing the same task, but depending on the attributes of the worker, such as age, gender and size, the work situation differs.

Deciding on solutions

The working party was then involved in research and testing the solutions. Using the video, the working party also identified the technical, organisational and social factors relevant to the particular work

situation. Following the study of the work situations, management decided which ones needed the most urgent attention.

After the solutions had been chosen by the working party leader (the managing director), they were presented and fully explained to the working party. The workers and the managing director collaborated in the working group to define how to test the solution. This included when, how long it would last, who would test it, what effects testing would have on normal work and how it would be set up.

The workers tested the solution and were filmed again. The solution was assessed using the video analysis system and reviewed by the group. During this stage, the aim was to enable the workers to see themselves in the future and understand how effective and relevant the solution was likely to be in reality before it was fully implemented.

Finally, the working party was involved in deciding how the final solution would be implemented.

The chosen solution was to introduce a seat that helps eliminate poor posture.

- **Case extract**

The working party members used paid working hours for training and to participate in the working group. The reduction of sickness absence outweighed the costs in terms of worker time and new equipment.

An important aspect of the meeting was to explain to the workers that the consultants were impartial and ready to listen to them. They explained that the results would remain anonymous and not be given to the company.

The workers tested the solution and were filmed again. The solution was assessed using the video analysis system and reviewed by the group. During this stage, the aim was to enable the workers to see themselves in the future and understand how effective and relevant the solution was likely to be in reality before it was fully implemented.

Resources, costs and benefits

The Regional Health Insurance Fund ran the intervention. The working party members were given time off work for the training and to participate in the working group. The company financed the new seats. The reduction of sickness absence outweighed the costs in terms of worker time and new equipment.

Analysis

- **Barriers**

No major problems were encountered.

- **Facilitators**
  - Support by the Regional Health Insurance Fund.
  - External ergonomics expertise to analyse the situation and guide the working group.
  - Management and workers collaborated, which can be more doable in a small business.
  - Workers involved in all stages of the process in a systematic way.
  - The worker opinions were an integral part of the expert analysis, and were used to modify and verify it.
- **Lessons learned**
  - Using worker's experience to verify an analysis by experts ensures that it is realistic.
  - Worker participation leads to a simple and practical solution.
  - Involving workers from the start and throughout the intervention allows them to see that they have a voice, and that their problems and ideas are acknowledged.
  - Worker participation in testing and implementation helps ensure it is done in a practical way with the least disruption.

- **Transferability**

This approach is transferrable to other sectors and organisation sizes. Although this example used video analyses and simulation systems, the same approach can be applied to follow up on other types of risk assessment and ergonomic analysis. Small organisations may need the support of external ergonomics expertise and a facilitator for the participation.

References and further information

The information on this case was compiled by EU-OSHA. No additional written material is available.

4.10 Case 8 - Participatory approach to reducing risks associated with musculoskeletal disorders for maintenance technicians

General information

Country: Ireland

Sector: Manufacturing (ophthalmic lenses)

Type of organisation: Manufacturing site

Size of organisation: Medium (about 250 employees)

Location: Urban

Job/tasks: Maintain machinery, operation of production

Workplace and task characteristics

The primary focus of the intervention was on the maintenance work. It entails practices such as the regular servicing of equipment, replacement of worn or non-functional parts, checks and repair work. Work is often performed in confined space with awkward movements and postures. One task was particularly problematic, where maintenance technicians worked in a static kneeling position and needed to use force to change the blades on a granulator.

- **Workplace participation measures**
  - Identify problems: Workers were encouraged to identify risk factors in their daily work by staying alert and reporting tasks that they are uncomfortable with or find difficult to perform. A questionnaire was also used.
  - Assess risks: Workers were included in an ergonomic assessment to analyse the task and identify risks for musculoskeletal disorders (MSDs).
  - Organise workshop: A workshop was held where the safety and health coordinator, maintenance technicians and other relevant stakeholders brainstormed to identify measures and solutions.
  - Implement solutions: The new solution was implemented, and both maintenance technicians and operators were consulted to make sure that the adjustments did not affect the operations on the production floor.

The action

- **Background**

Regular maintenance work is essential to keep a flow in production processes and make machines and the work environment safe and reliable. Often busy and tight production schedules require that maintenance activities be performed alongside running operations and in close contact with the machinery, during night shifts, or in limited time intervals where operations are on hold. Furthermore, maintenance work is often characterised as so-called unusual work, where maintenance technicians perform their work in complicated conditions without any standard operational procedures. Maintenance

tasks such as the exchange of valves, fuses and machine parts are often overlooked in companies' overall risk assessments since they are not part of the daily operations. All these factors mean that maintenance work can be associated with a greater risk of MSDs, but also with human errors that increase the accident risk.

The company had been aware of the maintenance technicians' particular challenges related to safety and health for some time. One of the first things the safety and health coordinator did to address these issues was to create a questionnaire to learn more about the maintenance department's difficulties. Although all workers had been through routine safety training and workers described safety as 'something we always talked about,' the exposed position of maintenance work had not been addressed before. Based on the questionnaire, a number of issues were identified and measures were implemented. Perhaps more importantly, these initial safety and health activities also led to maintenance technicians becoming more open about their problems and challenges. From being a division that often risked being overlooked, maintenance technicians now proactively approached both management and the safety and health coordinator with their problems. This led to the identification of uncomfortable and difficult tasks that required corrective actions, such as the one where maintenance technicians work in a static kneeling position and need to use force to change the blades on a granulator.

- **Participants and stakeholders**

To solve the identified problems, a multidisciplinary team was formed from multiple departments: both representatives from maintenance and daily operations, and the safety and health coordinator were involved in all steps of the intervention. Top management participated in key meetings and were otherwise kept informed about the progress on a regular basis.

- **Participatory approaches, methods and tools**

Identify problems

The maintenance technicians were encouraged to be aware of tasks that they find difficult or uncomfortable to perform, and then report these to their safety and health coordinator. As a result, one of the maintenance technicians reported a problematic working routine where the blades on a granulator had to be changed while sitting in an uncomfortable static kneeling position on a working platform with limited space. Furthermore, the awkward position resulted in a bad leverage position that required the maintenance worker to use more force to perform the necessary activities.

Assess risks

An ergonomics video assessment to identify the risks was completed by the safety and health coordinator in consultation with maintenance technicians performing the tasks. At the same time, operators who usually work in the area were consulted to make sure that potential changes would not have any negative effects on them and their work.

Organise problem-solving workshop

A multidisciplinary team was formed from different departments to brainstorm collaboratively on potential solutions. It was important to include all the stakeholders who could potentially become affected by the changes. Therefore, a representative of the operators and the supervisor responsible for the working area where the intervention would take place were also invited to join the workshop.

In an initial meeting, participants gathered to discuss the problematic working area and possible solutions. Although the workshop was held in a conference room, concrete solutions were discussed in the working area since this made it much easier to identify potential problems with the solutions. Operators who normally work in the area were consulted during the assessment to make sure that potential changes would not have a negative impact on them and their work.

Implement solutions

A new lower platform was installed with the help of an external company. Maintenance technicians are now able to change the blade on the granulator in a standing position on the lower platform. The platform solution was chosen because it would be easy to use, and therefore it would be used in practice.

- **What was achieved**

Sustainable measures through good communication between relevant stakeholders

All the relevant stakeholders whose work was affected were involved during the intervention. Feedback from the maintenance technician and the supervisor of the working area was that this comprehensive approach also resulted in an implementation without any problems. Even more important is the fact that the new platform is used every time when the particular task has to be performed.

Increased awareness and knowledge about ergonomic risk factors

The intervention strengthened the awareness of ergonomic risks and the importance of addressing them to create a safe and healthy workplace. The successful new measure both inspired and motivated workers to stay alert and continue looking for possible ergonomic risk factors. As the maintenance technician involved said: 'It makes a world of difference if you follow up on what people are worried about and let them know their input is valued.'

Improvements concerning productivity and efficiency

According to the maintenance technician, it is now easier to perform the task in a standing position that not only is more comfortable, but also gives a better leverage position. This reduces the time to change the blade.

Reduced use of force in awkward kneeling position

The new working position means that maintenance technicians can work without being exposed to MSD risk factors connected to work in static kneeling positions while using force to perform the tasks. The interviewed workers were very satisfied with the implemented measure.

- **Case quotes**

'Consultation with the operators who normally work in the area took place during the assessment to ensure the changes did not have a negative effect on them… Feedback from the maintenance technicians is that the task is now easier to perform, and it takes less time to loosen the blades while in a standing position. They are very satisfied with the change.'

'What I always do is that I create a storyboard that visualises the new measures with photos and short descriptions of the risk factors and how they are handled. We did the same in this case, where we placed it in the working area, so that everyone who went past it could see that something is happening. Those things really mean a lot to people.'

'It makes a world of difference if you follow up on what people are worried about and let them know their input is valued.'

If they have been involved enough, they will know this is a win-win, because for us it will get easier and safer to perform the job, and the company can guarantee workers wellbeing and safety.'

'After making the first changes related to ergonomic issues, the maintenance people became more open and approached me with their problems.'

Resources, costs, and benefits

- The safety and health coordinator was an expert in ergonomics and safety and could therefore offer guidance and help during the intervention that otherwise should have been provided by an external consultant.
- All the intervention activities took place during work time. The company financed an external fabrication company to manufacture the new platform solution.
- The cost of the intervention was approximately EUR 2,500.

Analysis

- **Barriers**

No barriers were identified.

- **Facilitators**
  - Operators who normally work in the area were consulted during the assessment to make sure that potential changes would not have a negative impact on them or their work.
  - The company in general and the maintenance technicians in particular had previously had good experiences with successful safety and health activities. This created an open and positive way of thinking among all participants that represented an important foundation for the following activities.
  - Visiting the work area while brainstorming for possible solutions was shown to be crucial to be realistic when considering potential measures.
  - The commitment of management was shown during the intervention by participating in key meetings and activities and showing its support.
  - A storyboard that described the new measures was placed in the working area, illustrating the changes with photos of the workers performing the tasks and short descriptions of eliminated or reduced risk factors.

- **Lessons learned**

Although interventions sometimes only have an immediate effect on a specific group of employees, it can also be very valuable to invite other stakeholders into the process who are affected by the changes on a secondary level. In this specific case, operators do not use the platform for changing the blades of the granulator. Nevertheless, they perform their daily work in the area and could potentially be affected.

Successful safety and health activities foster a climate where risks are taken more seriously and are acted upon more strictly. Consulting workers on MSD problems encourages them to become proactive in raising issues.

- **Transferability**

The described approach is transferable to other industries and sectors. However, it takes time and effort to foster a safety climate where workers proactively approach their supervisors and safety and health coordinators with problematic issues. Workers often need to see that those responsible act on their reports before they change their way of thinking and feel they have responsibility. To ensure all solutions are based on qualified ergonomic principles, an external expert should be contacted if the company does not have the expertise. In this case, this position could be covered by the internal safety and health coordinator.

References and further information

Health and Safety Authority, IE (2015). *Ergonomics Good Practice Case Study. Manufacturing Sector. Organic Lens Manufacturing.* Available at: https://www.hsa.ie/eng/workplace_health/manual_handling_display_screen_equipment/guidance_documents/ergonomics/case-studies-ergonomics-manufacturing-4pg-v6-copy.pdf

The report is supplemented with interviews of the safety and health coordinator, a maintenance technician and the supervisor responsible for the working area. Furthermore, background information was provided by the Health and Safety Authority of Ireland.

4.11 Case 9 - Worker participation to prevent musculoskeletal disorders in the assembly of boilers

General information

Country: Italy

Sector: Manufacturing

Type of organisation: Manufacturer of wall-mounted boilers

Size of organisation: 150 employees (involved 31 assembly workers)

Location: Industrial area

Job/tasks: Manual assembly work

Workplace and task characteristics: Repetitive movements, pushing the boilers, lifting (mainly with the forklift), standing workplaces, awkward postures.

Workplace participation measures: The main worker participation measure was worker focus groups and fault tree analysis using a participatory approach to identify and prioritise hazards, as well as to assess and develop solutions.

The action

- **Background**

Project start

Researchers introduced the project to the company to identify the causes of workplace hazards and to minimise occupational accidents and injuries. The project used an innovative participatory technique combining two methods: focus groups with workers (FGWs) and the fault tree analysis (FTA) method (see sections 2.3.1 and 2.4.1).

The aim was to identify leading indicators in determining critical factors that can cause occupational injuries and disorders. The researchers and representatives from the company started with an analysis of the root causes of accidents based on a public database managed by the Occupational Insurance Agency. The researchers developed a method that included getting workers to participate in identifying and prioritising occupational hazards, as well as developing solutions. The method focused on the factors that led to safe behaviour.

The main participatory approach was focus group discussions (workshops) with workers based on the FTA results. The focus groups' goals were to examine the consequences and causes of unsafe behaviour that may result in work-related musculoskeletal disorders (MSDs).

A major work task was assembling a wall boiler. Heavy and large items needed to be manipulated several times. The workers reported being tired at the end of working shifts. This tiredness meant they required more effort to do things, so they adopted more awkward postures. At the same time, the company claimed it had a proper and adequate work organisation and work cycle.

Fostering a culture of prevention

The company expressed that their workers were its most important resource. However, the project revealed the company did not have a strong prevention and participatory culture that involved workers in occupational safety and health (OSH) issues. After the project, the company used worker participation approaches to investigate other occupational hazards and improve working conditions. Meanwhile, the company made investments to demonstrate its commitment to improving safety and health, particularly regarding the assembly lines, equipment, plants and training programmes for all personnel. As part of establishing a prevention culture, the company required workers to comply with safety regulations to ensure safe behaviour according to company standards.

- **Participants and stakeholders**

In total, 31 assembly workers participated in the project. The assembly activity took place at different workstations, and included packing the assembled boilers. The workers rotated between the workstations during their shifts.

The researchers (safety professionals) designed the intervention by using a method that combined FGWs and FTA. The researchers had developed this method a few years earlier after several discussions with focus groups in different industries (manufacturing, food processing and construction). The researchers participated during the entire intervention. They first met the management (CEO, production manager, safety manager), the safety representatives and the trade union representatives to prepare for the intervention. During the intervention process, the safety professionals acted as moderators. To perform their analysis, the researchers divided the workers into three groups: two experimental groups and one control group.

- **Participatory approaches, methods and tools**

The participatory approach consisted of focus group discussions with workers that analysed risks and their causal factors (contributing causes) using FTA and FGWs. The aim of the FGWs was to facilitate discussions and gain knowledge about problematic areas in health and safety in workplaces. The purpose of the FTA was to guide the discussion with the workers who participated in the FGWs. For a particular risk, a fault tree is created that is broken down into subsidiary and basic casual factors. In this case, a work activity (boiler assembly) was broken down first into the various risk factors, which were each broken down into their consequences, and further broken down into the causal factors. When this was done, the preventive measures to tackle the casual factors and individual improvement measures needed to achieve each preventive measure could then be mapped out. The FTA provides a structure, but also offers the participants an easily understandable visual overview of all the risks and their causes that are associated with a particular task.

The intervention was divided into the four steps described below.

Step 0: Launch the project activity

The aim of Step 0 was to understand the organisation, get acquainted with safety personnel and safety procedures in the company, and explain the methodology. Two meetings were organised where two safety professionals met the relevant stakeholders from management (CEO, production manager, safety manager), the workers' safety representative and the trade union representative. Two additional meetings were used to study the job activities performed by the assembly workers and to form three worker groups: 2 experimental groups consisting of 12 workers each and a control group with 7 workers.

Step 1: Identify occupational hazards and worker perceptions of safety and health bottlenecks

Step 1 specified the activities performed by the workers and identified safety issues and risky work situations in the assembly line. Before the start, all participants filled in a questionnaire with 32 safety-related questions examining the assembly activities performed by the workers and the related risks prepared by the moderators and safety manager. The two intervention groups then participated in the first FGW moderated by the safety professionals. The moderator facilitated the discussion between the workers on details in the assembly activities and the related risks. The two groups identified 15 different risk factors during the assembly work shift. These included the ergonomics of the workstation, manual handling and repetitive movements. The control group did not participate.

Following this, all the participants completed a second questionnaire rating the effectiveness of the control measures for each risk.

Step 2: Identify consequences, causes and improvement measures

Step 2 covered a detailed examination of the issues identified in Step 1 to identify the consequences and causes of these risks and provide a complete overview of preventive measures to control them. Both intervention groups participated in a 90-minute focus group attended by the safety representatives. Using FTA, the workers' discussion helped to identify the potential consequences and causes of each selected risk factor. The moderators also invited participants to analyse the prevention measures used in the workplaces. Finally, the workers proposed possible improvement measures for the risk factors'

identified causes. The control group was not involved in Step 2.

Step 3: Assess occupational hazards and worker perceptions of safety and health bottlenecks

Step 3 assessed the project's effect on workers' knowledge about OSH in their workplaces. Two focus groups were conducted. Moderators promoted a discussion on the results of the procedure in Step 2. Workers from all three groups completed a second questionnaire that examined the workers' perceptions of the proposed safety measures for risks identified during the project. For each identified risk, the workers provided their perceptions of severity and probability (scale from 1 to 10) and their opinion on the adequacy of the proposed safety measures. This step was part of the research project to assess the effectiveness of the FGW-FTA methodology. The workers involved in the focus groups showed an increase in knowledge and awareness of occupational risks compared to the control group at the end of the project.

- **What was achieved**

Workers were involved in OSH activities through discussions and analyses of possible causes of health problems and accidents. In addition, they felt a high level of commitment and sense of involvement in developing better solutions. Although the external safety professionals (experts) were involved in the focus group discussions, workers felt quite comfortable in expressing their opinions, perceptions and ideas.

The result was an increased awareness among the workers about the importance of communicating and commenting to the management about any working condition that was a potential long- or short-term risk to workers, equipment or plant.

Workers' readiness and awareness were evaluated before and after the intervention. Workers' improved their knowledge and awareness of risk management (related to the manual assembly of the metal boilers), safety knowledge exchange, teamwork and cooperation. The awareness focused on MSD prevention by applying specific work procedures and postures, and following instructions for the use of equipment and tools.

The workers' assessment revealed the weaknesses of the existing safety preventive measures and proposed a set of effective and easy-to-apply improvement safety measures and corrective actions.

Participatory approach

The focus group workshops were the main participatory element. They involved workers in the analysis of consequences and causes of unsafe behaviour that may result in MSDs, accidents, or near misses. An important point was information about the project's innovative content and workers' leading role in identifying the risks and control measures of their own work. Additionally, during the focus groups, workers' participation in constructive discussions was stressed. These actions ensured workers' active participation in the workshops.

Because of the positive results, the company's management kept this approach to OSH and continues to apply it on its own. When the workers experience the responsibility for their actions and feel that their suggestions reach top management, they are motivated to contribute to their own safety and health, and to the safety of the whole organisation.

Solutions and improvements

Workers identified problems in the production line and proposed several improvements in the boiler assembly to control risks related to the falling of the boiler, cutting and slipping, as well as those related to ergonomics. For example, to minimise extensive push force in the assembly line, workers suggested replacing manual hooks with electric ones and increasing maintenance activities. Thanks to the workers' observations, the company was able to design and develop effective solutions for the assembly line process.

Worker satisfaction with the improvements

Workers expressed overall satisfaction with their contribution to improving the work environment. The workers reacted positively when the management followed up on their suggestions. For example, the interventions targeted work equipment, workstation layout, and also some modifications of the product assembly steps to ease component assembly.

- **Case extracts**

'The workers were positively hit by the interventions implemented by the management following their suggestions and recommendations for improving the work environment'.

The result was an increased awareness among the workers about the importance of communicating and commenting to the management about any working condition that was a potential long- or short-term risk to workers, equipment or plant.

Based on the inspection of job activities and review of safety documents, safety professionals prepared workshops, and stimulated and moderated discussions on workplace hazards.

The workers were informed about the innovative content of the project in the context of OSH training programmes and about their leading role in identifying the risks of their work and proposing risk control measures. Additionally, they were informed about the importance of their active participation during the focus groups, expressing the importance of everyone's contribution in developing a constructive discussion. These actions ensured workers' active participation in the workshops and discussions.

Resources, costs and benefits

- The National Institute for Insurance against Accidents at Work (INAIL) provided a grant for the project and the company management provided additional resources. INAIL's assistance was part of a programme for support from experts or researchers to companies.
- The main intervention costs related to planning and organising the workshops, for example preparation, refreshments, stationery and work time was financed by the company. In addition, there were the costs for implementing changes. The cost for the focus groups was comparable to traditional safety training programmes. Two safety professionals (experts) were involved in each workshop to stimulate and moderate the discussion and to analyse the root causes of workplace hazards based on the FTA. However, as mentioned, INAIL provided support for this. Furthermore, the cost-benefit balance for this activity was completely in favour of the benefits.
- The benefits of the approach adopted in the company included improved support from the workers to implement effective risk control measures, increased cooperation and teamwork, as well as an improved safety culture and involvement of workers in company health and safety activities.

Analysis

- **Barriers**
  - The support from a researcher or expert was important to begin the process, support workers in becoming familiar with the methodology and guide the whole process. It required additional costs for work time and improvement. Therefore, the methodology may not be feasible for micro and small enterprises.
  - The intervention process was relatively long (might take several months), and required dedication and time from both management and workers.
- **Facilitators**
  - The process of identifying risk factors was a core part of the intervention. The more relevant the identified risk factors were, the higher the learning process for the workers, and the more efficient and relevant the solutions and safety measures.
  - The proposed methodology was based on the active involvement of the workers and on their ability to learn from their direct experience. Moderators' skills to facilitate the active participation and discussions was crucial to the successful intervention.
- **Innovative feature**

The novel feature consisted of a participatory technique that combined two methods: FGWs and the FTA that helped to get beyond surface impressions.

- **Lessons learned**
  - For the successful implementation of this focus group approach, a strong commitment by management was required.
  - Two meetings were necessary to provide the company with a proper description of the FGW-FTA methodology and to retrieve the relevant safety documentation, such as risk assessment, adopted preventive and protective measures, and the register of injuries and near misses.
  - In addition, two inspections were necessary for the safety professionals (experts) to observe the assembly workers' job activities.
  - The workers' involvement in the discussion and analysis increased their operational awareness of risk management and improved organisational information dissemination among workers, employers and all the safety professionals within and outside the company.
  - Workshops organised during working hours can not only improve workers' participation and their involvement in identifying the occupational hazards and weaknesses in existing safety measures, but can also increase their commitment to safety, improve their safe behaviour and produce better solutions.
- **Transferability**

The participatory intervention is directly transferable to other manufacturing companies in other sectors and countries. It is better suited to larger and medium-sized companies instead of small ones. The researchers have successfully tested the same methodology in a waste management company and are planning new studies to develop the methodology further. However, with a trained facilitator, the basic approach to mapping out risks and their causes could be applied to organisations of any size.

References and further information

Mosconi, S., Melloni, R., Oliva, M., & Botti, L. (2019). Participative ergonomics for the improvement of occupational health and safety in industry: A focus group-based approach. *Proceedings of the Summer School Francesco Turco*, *1*, 437-443. Retrieved 15 July 2021, from http://www.summerschool-aidi.it/edition-2019/cms/extra/papers/581.pdf

For this case study, the publication was supplemented with two semi-structured interviews with a researcher and the company's safety manager.

4.12 Cross-case analysis

A cross-analysis of the nine cases was carried out. To improve understanding of the actions that workplace actors take during participatory change processes, the cross-case analysis aimed to answer the following questions:

- How does the workplace context influence the actions taken by workplace actors when undertaking participatory processes?
- How do workplace actors' actions in different contexts influence the success of worker participation?

To account for the relationship between the context, the actions and participatory outcomes identified in the nine cases, a realist analytical approach was used (Pawson & Tilley, 1997). This approach is particularly useful to establish what works, for whom and in what context. It enables complex topics, such as worker participation in workplace change processes, to be analysed so that causal processes emerge that can then be examined.

The analysis identified five overall principles for worker participation in MSD prevention. These principles break down into 13 concrete conditions that organisations of all sizes should consider when using worker participation to prevent MSDs. A short description of each principle and the conditions that comprise it is given. Each condition is illustrated with examples and arguments drawn from the cases. Table 5 summarises which of the 13 conditions was identified in each case.

Table 5 The participatory conditions identified in each case

Conditions	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Total
Alignment between core operations and workplace changes										
1: Workers' needs as the starting points for workplace changes	x	x	x	x	x	x				6
2: A close match between the workers' tasks and workplace changes	x	x	x				x	x		5
3: Workers' active participation in testing, evaluating and implementing workplace changes				x		x	x	x	x	5
Managerial commitment to and involvement in OSH										
4: A strong commitment to OSH by the management		x	x	x		x			x	5
5: Managers involve the workers in workplace improvements	x	x		x	x	x	x	x		7
6. Dialogue between workers and management on OSH issues					x	x		x	x	4
Distribution of roles and responsibilities										
7: Clear distribution of roles and responsibilities	x	x								2
Allocation of resources										
8: Support, guidance and training from external OHS consultants		x	x	x	x	x	x		x	7
9: Pre-specified and dedicated resources (time, equipment, facilities, funding) for worker participation	x	x	x	x	x	x	x		x	8
10: Clear communication about new initiatives to all workers, initially and throughout the duration of project				x		x	x	x	x	5
Room for innovation										
11: Learning from others	x	x	x	x	X	x				6
12: Innovative spirit		x	x		X			x	x	5
13: Stepwise approach with immediate action		x	x		X			x	x	5
TOTAL	6	10	8	8	8	9	6	7	8	

4.12.1 Alignment between core operations and workplace changes

Too often, well-intended, best-practice MSD prevention initiatives fail to embed new solutions in the core of daily operations. Workers generally want to do a good job and be efficient, and if they experience that the preventive measures hamper their performance of daily tasks, they will tend to disregard the new measures and continue to work as before. Embedding the preventive measures in the core operations, well aligned with regular tasks, and in accordance with the workers' needs is therefore key to worker participation. The report has identified three conditions that support the alignment of core operations with workplace changes.

- **Condition 1: Workers' needs as the starting points for workplace changes**

As a starting point for workplace changes, the importance of focusing on the workers' needs in relation to the core operation was identified in several cases. When workers actively identify the tasks they perform most frequently and consider to cause the most strain, new solutions that are aligned with these tasks are perceived as meaningful for the workers. The result is that the changes are more likely to be implemented and adopted by the workers.

An example from kitchen workers (Finland) highlights how the workers self-identified their needs: During the first workshop, which took place at the start of the intervention, they [the kitchen workers] chose between one and four work tasks that caused them the most strain, and an analysis of these work tasks commenced.

In the case of childcare workers (Denmark), this quote from an OSH consultant illustrates how the participatory approach and the focus on the workers' needs increased the relevance of the workplace changes for the workers: *'Many of the kindergarten teachers experienced physical pain, which made the workplace change relevant for them, as it focused on their needs'.*

- **Condition 2: A close match between the workers' tasks and workplace changes**

Workplace changes must also be organised around the specific tasks that the workers consider most important and the core of their daily operations – the core tasks. If the core tasks are identified and the preventive measures aligned with these tasks, the preventive measures are more likely to be applied in practice and become integrated in in the daily routines.

For example, for the kindergarten teachers, who focus on the wellbeing of the children, it is important that the workplace solutions help them care for the children:

Childcare (Denmark): *'The kindergarten teachers perceived the workplace change as meaningful when the solutions were closely associated with the core tasks. This is important so that the solutions at the same time were associated with the core tasks and ergonomic problems […] The workplace change effect on MSD-related sickness absence could therefore be explained by the children requiring less assistance, possibly making the childcare worker better able to work with the same level of MSD.'*

Another example from manufacturing shows how the redesign of workstations can be based on consultation with workers who operate the workstations, and how the solutions fit the core tasks of both the machine operators and the maintenance technicians.

Maintenance of machines (Ireland): *'Consultation with the operators who normally work in the area took place during the assessment to ensure the changes did not have a negative effect on them… Feedback from the maintenance technicians is that the task is now easier to perform, and it takes less time to loosen the blades while in a standing position. They are very satisfied with the change.'*

- **Condition 3: Workers' active participation in testing, evaluating, and implementing workplace changes**

MSD prevention in the workplace typically consists of a risk assessment followed by implementation of one or more preventive measures. Even when workers participate in these two steps, the process often stops there. However, workplaces may find it useful to conduct several rounds of testing and evaluation of the proposed workplace changes before final solutions are implemented. The participation of workers in the testing, evaluation and implementation of preventive measures is a highly useful process that

ensures that the final solutions are better aligned with the workers' needs and the core tasks, and usually results in higher worker satisfaction and a better integration in daily operations.

From an agribusiness production line in food packaging (France), a working group with worker representatives was assembled to validate a new production line and look for points to be improved before the line was started up. The result of the workers' participation in the implementation process was a reinforcement of their commitment to the new workplace changes.

Similarly, in maintenance of machines (Ireland), participation in the implementation of new preventive solutions both inspired and motivated workers to stay alert and keep on looking for potential ergonomic risk factors. As the involved maintenance technician stated: *'It makes a world of difference if you follow up on what people are worried about and let them know their input is valued.'*

4.12.2 Managerial commitment to and involvement in OSH

In all 9 cases, managerial commitment to OSH and continuous involvement in the change processes were key to successful worker participation in MSD prevention. Consistently, management responsibility for creating a positive climate for development of OSH practices was an important element. Managers are key to establishing a work climate that has OSH high on the company agenda and for setting a scene for OSH improvements. In order to do so, managers need to be knowledgeable in both OSH issues and the impact of MSDs on the workers and production. In addition, it is important that management welcome and integrate worker feedback on OSH in the daily operations of the company and collaborate with workers or worker representatives on OSH matters.

- **Condition 4: A strong commitment to OSH by the management**

A strong commitment to OSH by management, pre-dating the participatory intervention, facilitates worker participation. This is illustrated in the case from the food packaging industry (France), in which middle and top management held half-yearly workshops to get worker feedback and establish a common vision for health and safety issues; and in the case of the hotel staff (France), hotel management considered staff health and safety as important as guest comfort.

Managerial commitment has to be present, both when initiating change and throughout the participatory process. In the Danish childcare case, an OSH consultant concluded: *'The more management participate in start-up meetings, the higher the chance of success,'* and in the Italian assembly line case, the workers were *'were positively hit by the interventions implemented by the management following their suggestions and recommendations for improving the work environment''*

- **Condition 5: Managers entrust workplace improvements to workers**

Several cases illustrated the importance of involving workers in workplace improvements, not only in the participatory change process but also in daily operations. When workers are involved in critical analysis of their daily tasks and OSH prevention measures, and their opinions are encouraged, workers will see that they have a voice, and their problems and ideas are recognised. The process is one of mutual trust between workers and managers. This is illustrated in cases from the manufacturing sector:

Manufacturing (France): The plant's industrial director was committed to the idea that work should be organised to create continuous improvement through innovation. This approach involved pragmatism and a trust of those doing the work. The company philosophy involves continuous work improvement and trusting those on the ground doing the work.

Maintenance of machines (Ireland), company representative: *'What it really means is that people feel valued. And if they have been involved enough, they will know this is a win-win, because for us it will get easier and safer to perform the job, and the company can guarantee workers wellbeing and safety.'*

- **Condition 6: Dialogue between workers and management on OSH issues**

The commitment of managers to OSH changes can be operationalised through facilitation of dialogue between workers and managers. It is important that the dialogue is not only a one-time arrangement but gets embedded in the operational routines. Such dialogue results in workplace improvement in both short and long-term perspectives and the identification of easy-to-implement solutions that reach beyond MSD prevention.

Hotel staff (France): The project created a forum for sharing problems and simple methods to improve working conditions. It changed the perspectives on work and the way it was organised.

Assembly line (Italy): The result was an increased awareness among the workers about the importance of communicating and commenting to the management about any working condition that was a potential long- or short-term risk to workers, equipment or plant.

4.12.3 Distribution of roles and responsibilities

- **Condition 7: Clear distribution of roles and responsibilities to both workers and managers**

A strong facilitating factor in any change process is a clear determination of roles and responsibilities of the involved key persons. This is also the case when workers participate in MSD prevention. In the analysed cases, roles and responsibilities were allocated differently; some used steering groups to oversee the processes. In other cases, OSH consultants or other external intermediaries were responsible for facilitating the change process. Again, in others, bi-partite safety and health committees played a major role. Regardless of the organisation, clear descriptions of who is responsible for what is of high value, and it is particularly important to clarify the division of responsibility between workers and managers:

Carpentry (Belgium): The ergonomist and the manager were very committed to their mission, facilitating worker participation and anticipating production system transformation projects. The ergonomist communicated regularly with the manager to review the progress of the intervention. The manager was reassured about what was happening between the ergonomist and the carpenters.

Childcare (Denmark): A clear distribution of roles reduces the uncertainty about who has responsibility for the different tasks. Knowing who does what means that the nursery workers can concentrate on their specific work tasks.

4.12.4 Allocation of resources

- **Condition 8: Support, guidance and training from professional OHS consultants**

All of the included cases leaned on support, guidance or training from external OSH consultants, and the cases illustrate the benefits of seeking external help with worker participation processes. The change processes do not necessarily have to be run by external intermediaries, but at least a minimum training of workplace actors in both participatory change processes and MSD prevention is essential. The following four quotes illustrate some of the different roles of external intermediaries:

Food packing (France): The ergonomist gave the company the means to run and implement their existing approach. His involvement changed the way the company viewed stress and strain analysis.

Hotel staff (France): The expertise and support of the Regional Health Insurance Fund were crucial. The insurance fund proposed a method of training worker volunteers as prevention coordinators who would then involve other workers in prevention. The fund's aim was to provide businesses with internal competencies, relying only on themselves to diagnose and analyse risky situations and find the most appropriate solutions.

Childcare (Denmark): The external support from OSH consultants was important for the generation of solutions. If the kindergarten teachers had a hard time keeping up the motivation to implement changes, visits from the external OSH consultants increased their motivation.

Assembly line (Italy): Based on the inspection of job activities and review of safety documents, safety professionals prepared workshops, and stimulated and moderated discussions on workplace hazards.

- **Condition 9: Pre-specified and dedicated resources (time, equipment, facilities, funding) for worker participation**

Worker participation requires allocated (paid) time off for workers and other relevant workplace actors to participate in teams, discussions, meetings and other relevant activities. Funding may be required to acquire or modify new equipment if the process indicates that it is to implement new solutions. All of these costs should usually bring benefits in terms of both worker health and productivity. Allocation of

dedicated time as well as other resources (such as meeting rooms, camera to do video recordings) are important factors in all of the analysed cases. In two of the cases, return on investment was analysed and showed benefits, not only for the workers in terms of improved health but also for the company in terms of reduced sickness absence:

Vineyard (France): The working party members used paid working hours for training and to participate in the working group. The reduction of sickness absence outweighed the costs in terms of worker time and new equipment.

Food packaging (France): The time given to workers to participate in working groups and the steering committee allowed good participation of everyone in the projects. The financial resources allocated to automation were important, the objective being the preservation of health. Health figures have been improving in recent years.

In several cases, management invested in new equipment or modifications to existing workstations, which can be costly. However, the use of worker experience can be particularly helpful to find simpler yet practical solutions to help remedy a problem. The Danish childcare case illustrates, for instance, how inexpensive solutions contained within a small budget can be beneficial. One of the keys to success in that case was clear instructions to the workers about budget limitations. The instructions served a two-fold purpose: 1) to keep costs down, and 2) to specify clearly to the workers the premise of the change process. The low-cost solutions designed by the workers led to financially viable solutions and a high level of manager acceptance. The case therefore illustrates how the use of worker experience can be particularly helpful to find the simpler, yet practical, solutions to help remedy problems.

- **Condition 10: Clear communication initially and throughout the duration of project**

Implementation of new preventive measures of any kind requires a high level of clear communication to all affected workers. Successful uptake of new measures is dependent on the workers' knowledge and commitment to the process, and their level of confidence and certainty about the intervention procedures. All of this can be enhanced by clear communication to the workers throughout the lifetime of the change process and will ultimately increase the workers' engagement:

Maintenance of machines (Ireland): *'What I always do is that I create a storyboard that visualises the new measures with photos and short descriptions of the risk factors and how they are handled. We did the same in this case, where we placed it in the working area, so that everyone who went past it could see that something is happening. Those things really mean a lot to people.'*

Vineyard (France): An important aspect of the meeting was to explain to the workers that the consultants were impartial and ready to listen to them. They explained that results would remain anonymous and not be given to the company.

Assembly line (Italy): The workers were informed about the innovative content of the project in the context of OSH training programmes and about their leading role in identifying the risks of their work and proposing risk control measures. Additionally, they were informed about the importance of their active participation during the focus groups, expressing the importance of everyone's contribution in developing a constructive discussion. These actions ensured workers' active participation in the workshops and discussions.

4.12.5 Room for innovation

- **Condition 11: Learning from others**

The case studies include several examples of positive outcomes of knowledge-sharing at different organisational levels – both inside and outside the workplace. In the French case of hotel staff, knowledge sharing stemmed from the new hotel director bringing in previous experience at another workplace with OSH and worker participation. Another internal example is the food packaging case (France) where new workers shared their point of view with their supervisor, the line manager and the product technician.

Several examples of knowledge sharing with external companies and workplace visits were also conducive for innovation and new ideas (such as hotel staff in France and carpentry workers in Belgium).

In the food packaging case (FR), solution generation workshops with workers were held in different workplaces, which gave the workers the opportunity to see how others have managed MSD prevention.

Kitchen workers (Finland): Four workshops were held (one every fifth week) in different kitchens each time, giving the workers opportunities to familiarise themselves with other kitchens. In each workshop, progress on the development was discussed, and different solutions to the problems were examined and compared. Workers considered this to be a critical success factor.

In addition, simple sharing of ideas and knowledge between co-workers was seen to be conducive to generating ideas. Not only did workshops facilitate knowledge sharing, but they also contributed to a better collaboration and mutual understanding among workers.

Childcare (Denmark): Having time to have a nuanced and detailed talk with colleagues about challenges expanded the kindergarten teachers' consciousness about how to cooperate with colleagues and how to draw on each other's competencies and knowledge.

- **Condition 12: Innovative spirit**

The innovative spirit that often characterises start-ups and MSEs was mentioned as a facilitating factor for successful solution generation in several cases. Several participatory methods foster innovative ideas and solutions that create value for the workers and workplaces. Methods like future workshops, group discussions, and photo safari facilitate innovative thinking. Inspiration for innovative solutions may also come from other companies within the same sector or from across departments in the same company. This was shown in the French manufacturing case, where representatives from ten different companies were involved, which motivated thinking about practices and generated ideas.

In the Belgian carpentry case, members of the steering committee decided to visit an external workshop. Their tour of this workshop and their discussions with its users led to new ideas emerging for the future workshop development.

In the cases, it was seen that facilitating innovation in a participatory process may inspire and transfer to other parts of a company, as in the French manufacturing case: The spirit of innovation seen with this group of workers spread to other production lines.

- **Condition 13: Stepwise approach with immediate action**

A stepwise approach to implementation of new solutions was perceived as useful for several reasons. Ideas that are easy to implement can be put into action immediately. When workers experience those immediate actions and see MSD reduction as a result, they feel motivated to keep on using the solutions. In addition, the stepwise approach may be a viable way to gain workers' trust and confidence in the participatory process:

Food packaging (France): Safety reviews are organised every week with the workers, line managers and assistants. The discussions often led to easy-to-implement solutions that facilitate the work.

Childcare (Denmark): *'… they can see it makes a difference. Experiencing themselves that they have less pain…'* (OSH consultant).

Maintenance of machines (Ireland): *'After making the first changes related to ergonomic issues, the maintenance people became more open and approached me with their problems.'* (OSH consultant).

A stepwise approach is also a means to ensure relevant and valid solutions through several iterations and refinements:

Vineyard (France): The workers tested the solution and were filmed again. The solution was assessed using the video analysis system and reviewed by the group. During this stage, the aim was to enable the workers to see themselves in the future and understand how effective and relevant the solution was likely to be in reality before it was fully implemented.

PVC Manufacturing (France): If an idea was suitable, it was implemented immediately ... [Other] improvements were made gradually, looking at different potential paths and amending things that did not work. The aim was to produce a machine that, by the end of the process, responded perfectly to risk prevention and comfortable use criteria set by users.

5 Overview of principles, conditions and success factors for effective worker involvement in MSD management

Chapter 5 provides an overview of the principles, conditions, and success factors – beyond the minimum legally required – that are important for worker participation in MSD prevention. This builds on the methods presented in chapter 2 and the case descriptions in chapters 3 and 4. Firstly management responsibilities and pre-existing and underlying conditions that facilitate participation are described, followed by the success factors related to the participatory change process, including the allocation of resources. The various factors are summarised in a box at the end of the chapter.

5.1 Managerial commitment to OSH and the participatory climate

Strong, effective, and visible leadership is vital to good workplace safety and health. In turn, good safety and health is essential to the success of a business. Therefore, management plays a key role in initiating and supporting worker participation in MSD prevention. They do so in initiating the participatory process, and subsequently through their willingness and commitment to follow through to the end result. Senior management is strongly positioned to support a participatory process by prioritising OSH in the company philosophy, core values or mission. This can be operationalised through company OSH policies and strategy statements, and by continuously having OSH and worker participation on the agenda at executive meetings. It is important to realise that the lack of managerial support or buy-in on the process at all levels of worker participation in MSD prevention is an important barrier for success.

Focus and action must be directed towards a committed and supportive managerial role; otherwise, managerial lack of commitment will hinder the participatory process and the end result will be at best a waste of time and money or at worst detrimental to workers' health and wellbeing. Therefore, worker participation is a part of management responsibilities. In practical terms, managers and supervisors need to set good examples by participating and engaging in meetings (motivating and encouraging workers to participate), raise awareness of OSH issues, provide training in OSH and MSD prevention, and prioritise resources needed for the process.

Successful worker participation is enabled through embedding the participatory processes in existing organisational OSH structures such as OSH committees, collaboration with OSH representatives, and clear specifications of management responsibilities in OSH. Management can facilitate worker participation by developing robust OSH management systems with a blame-free and open organisation culture in collaboration with workers or worker representatives. Worker involvement in daily work organisation and decision-making on daily operations also facilitates participatory change processes. In the case of workplaces undergoing transformations (organisational changes, introduction of a new production line or relocation), the moment is opportune for the implementation of participative and preventive approaches as part of the transformation project.

A well-functioning and collaborative OSH organisation may already be present in the organisation, but if not, a participatory process may be the start of establishing a sound OSH organisation and a fruitful worker-management OSH dialogue.

A successful participatory process is contingent on collaboration between management and workers both directly and through worker representatives ([2]). A prerequisite for a constructive collaboration is an open and sincere dialogue and mutual trust between the parties. Dialogue must be two-way, and workers must know that their views will be taken seriously and acted upon. The collective work of a worker-manager OSH organisation will increase the knowledge of each other and lay the foundation of trust between the parties. It takes time to get to know each other and build up trust, and it is an essential management responsibility to communicate openly and fully – throughout a participatory change process – about the participatory initiatives. Annex 4 lists the key points that should be considered when developing arrangements for both direct and indirect participation.

Being in a position of power, management must ensure protection against reprisals for workers who share honest opinions and specifically declare this to the workers. Participants' understanding of what

([2]) While worker safety representatives are more common in larger organisations, there is evidence that their presence in smaller organisations has a greater impact on OSH management (ESENER, 2017).

they are agreeing to at the beginning – even when genuine – may not be complete. As worker participation evolves, their agreement may have to be negotiated more than once. Thus, clear communication about new initiatives to all workers, initially and throughout the duration of project, is needed.

When undertaking a participatory process, managers should be prepared to truly listen to and act on the problems and solutions offered by workers, even if the offerings are contradictory to company and management priorities. All too often, managers ask questions only about issues that they want to address or take only answers that fit their own agenda. That being said, it is an equally large responsibility for the workers to speak up and voice their experiences and opinions, but this will only occur if their confidentiality and job security are established.

5.2 Initiating a participatory change process

When initiating a participatory process, the first important step is to identify all relevant workplace stakeholders and make sure they are invited to join the process. Often, this will require participation of representatives from all departments or levels of the company. Stakeholders need to be included from the very beginning of the process. If not, important implications on other parts of the organisation or in later workflow tasks may be overlooked. Early involvement also facilitates uptake of the suggested changes through sense of ownership of the solutions. The specific roles and responsibilities of involved stakeholders needs to be clearly communicated and maintained throughout the process.

Often, a steering committee with both managers and worker representatives will be helpful in maintaining a strong focus on the process and the responsibilities of those involved. Furthermore, including key representatives with different professional backgrounds and responsibilities in the organisation offers the opportunity to address challenges in a multidisciplinary way. It is important that the steering committee share and communicate a common goal of improving working conditions and work performance/quality.

Workplace actors may have differing opinions on the cause of workplace problems, but if the participatory change process is to result in positive outcomes, the workers' needs must be the starting point for workplace changes. Starting from the actual needs of the workers increases the relevance of the workplace changes, and ultimately secures the workers' commitment to these changes and their implementation.

The workers know their work tasks best and therefore are more capable of identifying the tasks that are performed most frequently and considered to cause the most strain. When workers actively identify these core activities in the daily operations, the new solutions will be well aligned with core operations. Full integration of MSD preventive measures into the core activities of daily operations is key to successful uptake of workplace changes. This can be accomplished by the participation of workers from the initial risk assessment through solution generation to the integration of solutions in daily operations and subsequent monitoring and evaluation.

Involving workers in testing, evaluation, re-testing and gradual implementation of solutions through an implementation plan is a useful process that ensures that the final solutions are better aligned with the workers' needs and the core tasks. Often, several rounds of testing and revision of the ideas are needed; the process results in solutions that better match the workers' needs, leading to higher worker satisfaction and more successful integration into daily operations. Another argument for a stepwise approach to testing and evaluation is that ideas that are easy to implement can be put into action immediately, while others involving more time or resources are timetabled for implementation in the medium or longer term. When workers experience that the process leads to immediate actions, they are motivated to keep on using the solutions. In addition, the stepwise approach may be a viable way to gain workers' trust and confidence in the participatory process. Having a clear implementation plan that is agreed on and shared with workers also allows them to see that more significant changes will actually be addressed.

5.3 The participation should be inclusive of women and men

Adequate workstation and tool design may be missed if women do not participate, as women and men differ in height, strength and bodily dimensions. Women may work part-time or have caring responsibilities. Discussions, training and so on should be held when they can take part. Women may be hesitant to volunteer for working groups or steering committees, so it is important that they are encouraged to take part. When meetings take place, the views and suggestions of women and men need to be obtained and listened to. Allowing women to meet together to discuss an issue may be useful in some situations. (ILO, 2010; EU-OSHA, 2003). Similarly, other sectors of a diverse workforce need to be included (EU-OSHA, 2010).

5.4 Allocation of resources

To fully engage in the participatory processes, some workers and managers need training in MSD prevention, such as work analysis and/or facilitation of change processes or group leadership. Especially, workers assigned roles as ambassadors or coordinators need training to be effective in their role. Training also facilitates a heightened awareness of OSH matters in general and is therefore a long-term investment in workers' health. Training may come from OSH professionals, but also from other qualified persons. Workers can also carry out training, for instance, building on train-the-trainer principles, which are effective tools to engage workers in participatory processes. Other effective knowledge-sharing strategies are peer-learning and exchanges with other workers and professionals in the same sector through worksite visits to other departments or workplaces.

Together with support and guidance, training provided by either internal or external OSH professionals support the participatory process. Internal OSH professionals have the benefit of in-depth knowledge of the organisation and the work tasks, whereas external professionals have the benefit of bringing in external expertise that may supplement internal organisational skills and knowledge. External professionals can be viewed as more independent from management and, therefore, there may be higher confidence from workers to speak freely. Depending on the needs, the professionals may be more or less involved in the process – from consultation on a few matters to being in charge of conducting the participatory change process. Often, the professionals have specific skills and tools to analyse situations, initiate and moderate discussions, and facilitate change. As with the other stakeholders, OSH professionals must be involved early on in the process to make full use of their competencies. However, it is important to keep the ownership of the change process with the local stakeholders, otherwise the participatory process risks being pushed to the side.

A participatory change process takes time and effort, so management must be willing to allocate time off work with the normal salary for workers to engage in the process. Furthermore, resources need to be allocated for training, OSH consultation, development, testing and implementation of solutions. Depending on the situation, the budget for the solutions does not have to be large, but more importantly, the size of the budget needs to be clearly communicated to the workers and/or designers. However, as mentioned, budget for the implementation of solutions can be planned over the short, medium and longer term. And the benefits of reduced MSDs to workers and improvements in productivity are likely to offset costs.

Box 4 A summary of the principles, conditions and success factors for effective worker participation

General prerequisites

- Senior management commitment to and leadership on participatory MSD prevention and OSH management;
- A blame-free and open dialogue culture on MSD prevention and OSH with workers and their representatives;
- Worker participation as a part of managers' and supervisors' day-to-day responsibilities;
- Workers are trained in OSH and MSD prevention and how they can participate;
- Structures and procedures to support participation, such as safety committees, reporting procedures for workers, and items for OSH discussion on agendas of meetings;
- Combining the use of worker representatives with direct participation of workers;
- Prerequisites for a particular intervention;
- Clear communication about the objectives, duration and role of workers in the start and during the intervention;
- An open approach to discussing the problems and generating solutions;
- Build on individual participatory intervention to improve OSH management and worker participation in the future;
- Initiating a participatory intervention;
- Identify and involve all relevant stakeholders from the beginning;
- Clearly defined roles and responsibilities of the different stakeholder;
- For larger interventions a steering committee that includes managers and worker representatives;
- With the aim of effectively incorporating MSD prevention measures into daily operations
- Focus on workers' needs from the start;
- Involve the workers throughout the process
- Involve workers in testing solution options before full implementation;
- Involve workers in setting an implementation plan with actions to be taken immediately, and in the shorter, medium and long-term;
- Allocation of resources;
- Provide the necessary training in MSD hazards, risk assessment, prevention and participatory processes;
- If relevant involve OSH professionals such as ergonomists to guide the intervention. If used: involve OSH professional from the beginning;
- Keep ownership of the process with local stakeholders;
- Allocate sufficient paid time off work for workers to be involved;
- Allocate sufficient budget for training, consultations, development and testing of solutions;
- Inform about budgetary limitations, and explore the full range of solutions – more expensive ones may be over the longer term.

6 Good practice tips and checklist for small businesses

6.1 Introduction

MSEs face particular challenges related to general OSH issues (Walters et al., 2018b). Worker participation in MSD prevention in MSEs will be met with similar challenges. MSEs generally lack the managerial and professional expertise and resources available in larger enterprises. The owner-managers are responsible for both OSH and MSD prevention alongside all other business challenges. However, MSEs also have advantages. The close contact between owner-managers and workers – most often on a daily basis – results in social relations and trust that create an opening for a participatory process. This chapter uses this strength to suggest a number of good practice tips that owner-managers together with workers in MSEs can use to initiate and carry out MSD preventive efforts. Given the OSH challenges that MSEs face, it is especially important that they take advantage of the benefits that worker participation brings, and the use of worker experience can be particularly helpful to find the simpler yet practical solutions to help remedy problems.

6.2 Good practice tips

1. Start with the workers' needs

A good participatory process starts with the workers' needs. The workers are the ones who know their work tasks best. They feel on their own body where it hurts, and they experience the constraints caused by MSDs in their daily work. It is important to capture individual differences and diversity of the workforce related, for instance, to body size and gender. The pain and constraints are risks to the workers' general health and hamper productivity and quality. To best counter this, ask workers about their complaints and constraints and what they think is causing them, and use the responses as a stepping-stone for change. If the changes start with the workers' needs, the involvement and motivation of the workers will increase. As MSDs stem not only from the physical demands at work, but also from psychosocial factors at work and at home, allow both to be covered by the participatory activities. Other workers may be affected by any change to how one group of workers works, so they and others, such as maintenance workers, may need to be involved. It may also be necessary to involve people outside of the organisation, such as goods suppliers and their delivery workers.

Good practice advice:

- Recognise that workers know their bodies and are the best at identifying the causes of pain and constraints.
- Start by asking workers about their MSD complaints and what they think causes them.
- Cover both MSDs and stress factors in participatory activities.
- Recognise that some workers are more susceptible to risks than others.
- Ensure that all workers (women, men, migrants, young workers, and so on) have an opportunity to actively participate.
- Involve all who could be contributing to problems or affected by changes, not just the workers directly involved.

2. Engage in dialogue and organise meetings

Dialogue between the involved workers and the owner-managers is the best way to identify priority problems and select practical solutions. It is a good idea to separate the dialogue into two phases with a minimum of one meeting in each phase:

- The problem: The first phase should focus on examining the problems: What are the most important problems? Who are they a problem for? What causes the problems? The risk is to jump to early conclusions before the problem is fully understood. Let the workers talk, and listen to their concerns.
- The solutions: The second phase should focus on generation of ideas for solutions. It is a good idea to list all possible solutions in a brainstorm process and subsequently select the ones with the best potential for further analysis: To what extent will the solution solve the problem? How difficult is the solution to implement and sustain? What is the cost? How can the solution be

integrated in the daily operations? Involving workers in the in the idea generation of solutions helps to give them ownership and can breakdown any reluctance to change.

Annex 5 provides more information on brainstorming and Annex 6 contains a work sheet for developing solutions.

Good practice advice:

- Assess who suffers from MSD and what causes the problem.
- Identify both directly and indirectly affected workers and include them in the participatory process.
- Allocate sufficient time for meetings.
- Engage in dialogue with the workers and acknowledge their concerns.
- Encourage workers to take part in an open dialogue and allow sufficient time to discuss and understand the problem.
- Brainstorm solutions with workers and other relevant stakeholders.
- Analyse and discuss the solutions and breakdown benefits and costs.

- **3. Prioritise the most important changes**

A brainstorm process will potentially generate more ideas than what is feasible to implement. Agree on priorities jointly between owner-managers and workers. Start with a few actions (perhaps three to five at one time), as working on too many actions at once will slow down the change process. The first solution to be implemented should have a high chance of success. Easy wins, with changes that are quick and simple to implement, help to build confidence in further improvements that take longer time to complete.

Annex 7 contains a template for making an action plan.

Good practice advice:

- Prioritise three to five solutions to begin with.
- Start with the easy wins to provide some quick successes.
- Prepare for a longer process with more difficult or complicated solutions.

- **4. Distribute responsibility for implementation**

When the best solution is selected, it is time to put it into practice. Often it is a good idea to ask the affected workers to take responsibility for implementation. It eases the work burden of the owner-manager and increases the motivation of the workers. The owner-manager approves the arrangement and budget, but otherwise leaves the practicalities to the workers. Make sure everybody in the workplace knows who is responsible for the implementation.

Good practice advice:

- Delegate responsibility to the workers affected by the change (or a team of workers).
- Trust their know-how and skills and let them know that you trust them.
- Clearly communicate to the workers the budget for the solutions to avoid unrealistic expectations and disappointment.

- **5. Test, review and refine implemented solutions**

Solutions rarely work perfectly from day one; usually some modifications are needed. For example, if a new lifting aid is not easy to use or not easily accessible, it will end up not being used. Often several (pilot) tests involving one or more workers of alternative solutions will lead to refinements, which in turn helps the implementation process. The refinements of the solutions should be based on the workers' experience and simple tests in the worker's practical work, both to make the necessary adjustments and to ensure that improvements will be used in practice. Get feedback from all workers during testing, for example in meetings or workshops or toolbox meetings at the workstations. With larger groups of workers, a very short survey can also be used. Very often, a 'one-size fits all' model does not work well in MSD prevention. Different workers may have different requirements and thus require adaptations to

a given solution. Special attention may be needed to adapt solutions to the needs of minority groups of workers.

Good practice advice:

- Before full implementation, allocate sufficient time for pilot testing, reviewing and adjusting solutions.
- Once implemented and continuing thereafter, review and adjust the solution if needed.
- Listen to input from all affected workers.
- Be prepared to choose flexible or multiple solutions.

6. Embed changes

Often the improvements disappear as workers fall back into old habits. This usually happens because the workers have not been sufficiently involved, and the changes do not adequately address the workers' needs, tasks and workflow. Therefore, the solutions do not become sufficiently incorporated in the daily work. But even with relevant solutions, reminders and checks may be required. This could be done during team meetings, or perhaps a 'champion' among the workers could advocate for the change.

Good practice advice:

- Follow up on the newly implemented solutions in staff meetings, during rounds, toolbox meetings and so on.
- Allocate workers to become champions for the change and assist them in their task.
- Use posters with photos to make workers aware of the change.
- If workers are not using the solution, ask them why not and what they suggest needs changing.

7. Seek advice when needed

It is often a good idea to look for advice outside the business. Often other small businesses in similar sectors have the same problems. Perhaps a peer from another small business has a good idea that can inspire the change process or help advice could be found through the relevant trade association? There is an abundance of good advice on the internet from private and public OSH organisations. Sometimes national guidelines for a specific sector are available; at other times, guidelines from other sectors may be applicable with only a little adaptation. In some countries and sectors, small business can draw on external OSH professionals for assistance to organise the process and identify problems, such as work insurance organisations. If you are contracted by a larger organisation, their OSH department may have information for their contractors. However, the point of departure is always the workers' experience of problems and of the applicability of solutions. Therefore, many improvements can be made without depending on external assistance. However, if an MSD problem is causing worker absences and affecting productivity, investing in some external support could be a sound investment.

Good practice advice:

- Look to peers and other small business: How have they solved the problem?
- Search the internet for sector specific and non-specific guidelines and advice.
- Look for external OSH professionals to guide the process, help identify problem, and point towards solutions.

8. Keep all staff posted at all stages

A high level of communication is key to continued engagement in the participatory process. First of all, utilise the daily encounters to talk about the participatory process: What is going on? Who are doing what? What is the next step? and so on. If needed, add written information on notice boards, in emails or other means.

Good practice advice:

- Engage in daily dialogue with the workers about the process.
- Put the participatory process as a regular item on the agenda for staff meetings.
- Use notice boards, emails etc. to communicate in writing.
- Allocate the communication responsibilities to a dedicated worker.

6.3 A short checklist for small business

To follow the participatory process to a successful completion, this checklist can be used to check as every step is accomplished.

	Worker participation step	Accomplished	More to do	Not applicable
1.	Listen to workers' concerns related to MSDs			
2.	Organise meetings for identification of problems and solutions generation			
3.	Most important suggestions identified			
4.	Responsibility for implementation of suggestions allocated			
5.	Suggestions implemented, tested and refined			
6.	The implemented suggestions are embedded in daily operations and applied in practice			
7.	The possibilities for external advice have been scrutinised and utilised as far as possible			
8.	Workers are fully informed and involved during the daily contact and other communication means			

- **Technical resources**

For ideas for technical solutions, the ILO (2010) provides 'Ergonomic checkpoints', which is a free resource that contains 132 inexpensive, easy-to-apply ergonomic improvements; each in a checklist format asking whether the improvement is relevant or not, and if so, whether implementation is a priority. It is available in book and phone app formats at: https://www.ilo.org/global/topics/safety-and-health-at-work/resources-library/publications/WCMS_438082/lang--en/index.htm

OHSCO (2007) provides a detailed resource that gives step-by-step guidance and practical tools for making an intervention to prevent MSDs. This includes a brainstorming tool that may help identify options and ideas for MSD hazard controls (see Annex 5), example of a survey that can be used to collect workers' opinions of the controls, and a 'One-minute employee feedback survey'. The resources are available at: https://www.iwh.on.ca/publications/msd-prevention-series.

Annex 8 provides a model for change management through continuous development that includes testing and refining solutions. It is adapted from a model provided in the Finnish publication 'People in designing work and the working environment – handbook for the proactive planning of work and design of working environments'.

Additionally, Annex 4 presents two checklists for effective worker participation that cover the key points that should be considered when developing arrangements to improve worker involvement.

7 Discussion

7.1 Introduction

European legislation on OSH at work demands that workers be consulted and involved in discussions on all questions related to OSH. This principle is established in national laws across Europe through the provisions of the EU framework directive (89/391/EEC), which sets minimum requirements on worker consultations (see Appendix 1). Broadly speaking, employers must consult workers and/or their representatives and allow them to take part in discussions regarding safety and health procedures, operations and policies. Within this context, employers must respect the right of workers and their representatives to make suggestions and participate in OSH activities. National legislation sets specific requirements on these practices, but there are benefits to going beyond the minimum requirements. Management will be more likely to succeed in OSH management if it encourages the active participation of workers and sets up dialogue between employees and themselves. Worker participation is an essential contributor to implementations of strategies towards risk mitigation (Nunes, 2016); thus, promoting participation will support changes that have the potential to enhance and optimise future performance of the work systems (Eurofound, 2001; Sisson, 2000).

A wide variety of participatory methods, approaches and examples of interventions seen to be relevant to achieving worker participation in MSD prevention have been presented in this report, (although the improvements in OSH in the examples has not been subject to particular analysis). The aim is to provide concrete experience and inspiration and this discussion section focuses more broadly on what makes worker participation work, for whom and under what conditions. In particular, the section does this by looking at whom to involve, how to involve workers, what to involve workers in and when, how much influence they should have and how to organise.

7.2 Who, what, when, how much and how?

- **Whom to involve?**

This report defines worker participation according to the tradition in participatory ergonomics as simply involving the persons at the workplace in problem-solving (Kuorinka, 1997; Van Eerd et al., 2010). While successful interventions require the right people to be involved (Van Eerd et al., 2010), it can be seen that participation can have a multitude of meanings.

All relevant stakeholders: While it is obvious that the directly affected workers need to be involved for effective MSD prevention, the cases and examples identify a broad range of workplace stakeholders, and even stakeholders from outside the workplace that may be important to involve in all or parts of the process. For example, it is important to ensure that a solution does not adversely affect other parts of the organisation, or how other operations are carried out, for example, the way goods are packed and delivered can affect MSD risk factors on the production line. Several of the examples involved maintenance workers and show the importance of involving such groups of minority workers.

Therefore, it is essential to consider stakeholders from the entire organisation/production chain; this also includes internal planners and technicians, and suppliers and/or customers, who may help in developing good solutions owing to a mix of special skills. For example, if how goods are delivered are part of a manual handling problem, then suppliers and the workers delivering the goods need to be part of determining the solution.

Vulnerable groups: It is important to note that some workers, who may be most at risk of MSDs because of the high physical demands of their jobs, may be the most difficult to involve effectively. This includes migrant or temporary workers such as seasonal workers in agriculture sector or in cleaning and service jobs. These workers, along with young workers and other minority worker groups, often have a weaker voice in the workplace due to their precarious employment situation and/or lack of language proficiency and are easily overlooked. Therefore there is a special need to ensure that these groups of workers are adequately included in the participatory process, and their particular problems sufficiently addressed.

Gender: Successful participation is inclusive of women and men. Adequate workstation and tool design may be missed if women do not participate, as women and men differ in height, strength and bodily dimensions. Women may work part-time or have caring responsibilities, which influence when they can take part in discussions, training and other activities. Women may be hesitant to volunteer for working groups or steering committees. When meetings take place, the views and suggestions of women and men need to be obtained and listened to. Allowing women to meet together to discuss an issue may be useful in some situations.

Qualified facilitation: Internal OSH professionals (such as ergonomists and safety engineers) and external ones from private or public organisations may play an important role in facilitating a participatory process. Some of the simplest versions of the participatory methods can be applied directly by a manager or group of workers, but without prior experience with worker participation, it may be difficult to reach a successful participatory case. Facilitation of worker participation in MSD prevention requires a specific set of skills and building up mutual trust between all stakeholders. As the manager-worker power balance favours the manager, workers may refrain from truly airing their voice to a manager-facilitated process, especially in more hierarchical organisations. Therefore, it may be helpful to involve an impartial facilitator for support and ensuring the workers' voice, or for even being responsible for the participatory process.

Relying too heavily on an external OSH professional, however, comes with a price. If too much responsibility is pushed to the OSH professional – and it can be tempting as they are qualified and have time – solutions will not become long-term sustainable. To overcome this, external OSH consultants can be used rather to train workers in MSD prevention and participatory change processes. They thereby provide the necessary skills to workers and the workplace to continue worker participation as part of an overall OSH strategy for long-term sustainable changes.

Management commitment: A final comment to the question of *whom to involve* relates to the managerial commitment. This report has consistently identified lack of managerial commitment as a barrier for successful worker participation, whereas managerial commitment facilitates the process. This implies that concerted actions must be taken to ensure the commitment. It cannot be overlooked, as lack of attention will hinder the process. Equally important, commitment is necessary throughout the entire process from the first activities to the final integration in operations. Managers obviously have the power to make decisions about changes in the workplace. This power also leaves a specific responsibility on management. If they initiate or authorise a participatory process, they must be committed to go all the way and among others authorise the changes that develop during the process. A participatory process that fades out halfway has severe consequences. Workers get disillusioned and lose motivation – not only for the participatory case, but also on a broader scale related to OSH and other activities in the workplace.

- **How to involve workers?**

Direct and indirect participation: A first question related to *how to involve* is whether participation should be direct or indirect through representation. Direct participation has the advantage of ensuring that all affected workers are involved and thereby get a voice in the workplace changes, which normally results in stronger embedding of changes. Direct participation is useful in small workplaces or in teams at a larger workplace, whereas in cases where many workers are involved, some kind of representation is normally needed. Indirect participation can take place through the permanent OSH organisation and representative structures, but it can also be organised with designated working groups with workers representing larger groups of workers. It is always important to involve elected worker representatives. The presence of worker representatives is associated with improved OSH, including in small organisations (EU-OSHA 2012a and 2017). Depending on the context, it can be helpful to organise two levels of participation with a steering group consisting of worker representatives, management, union representatives, shop stewards and/or OSH representatives to oversee the process, assess participatory performance indicators and make final decisions, and separate working groups with the directly affected workers. Therefore, direct and indirect participation are not alternatives, but are complementary ways to be combined as effectively as possible (HSE, 2005; WHO, 2010).

Active and passive involvement: The methods presented in the report show that there is a wide variety of ways to involve workers. It can be done through questionnaires, interviews, meetings, workshops, and training, as well as practical testing and change activities. The findings of this report indicate that

higher levels of direct involvement with involvement of many workers through dialogue creates stronger engagement and more sustainable solutions through ownership of the process, whereas for instance passive surveillance by means of questionnaires or observation offers little opportunity for engagement in change. Nonetheless, sometimes it can be a good idea to use a questionnaire to get an overview of worker experiences to identify priority problems before more direct participation is organised. The important point is that the workers have a direct say in the change process and decision-making, and that their opinions are valued and actively included in the process. If the workforce is larger, involvement of all workers through a survey and a smaller group of volunteers in workshops can be a practical option. But in this case, it is important to keep all the workers informed of progress and outcomes.

Time and resources: Engaging in a participatory process takes time and allocation of sufficient time for the process is a prerequisite for a successful process. Workers may have different opinions and experiences, and it may take time to reach conclusions and develop good solutions. Workers also need to have a clear understanding of the link between the participatory process and MSDs. A premier facilitating factor is adequate allocation of time and resources for these processes. These pre-conditions together with management support are not specific to worker participation, but necessary in any ergonomic intervention or OSH programme.

Communication: Communication is one of the most noted success factors or barriers for participatory MSD interventions (Van Eerd et al., 2010). Good communication is needed at all stages, including during planning of an intervention, while the intervention is taking place and during follow-up afterwards. Especially where not all workers are active in all stages of the intervention, for example where teams involving only some workers are used, or only a few workers are involved in trialling possible solutions, all the other workers need to be kept informed of progress. All workers who will be affected by a measure need to know about the proposal and, where necessary, trained in its use. Even well-designed and implemented controls can be less successful than they should be if the communication is poor, so it is also important to communicate the results of an intervention and acknowledge success (OHSCO, 2007). OHSCO (2007) recommended: keeping all staff up to date on progress; acknowledging all workers involved in the process; communicating the results of the evaluation, and celebrating successes, but also being honest and open about any problems.

- **What to involve workers in?**

Participation across all phases: Throughout this report, a worker participation cycle has been used to illustrate phases in worker participation. For worker participation to result in successful and sustainable MSD preventive changes, participation in all phases, from risk assessment to integration into operations is required. Risk assessments that do not lead to meaningful changes, or a solution generation process without implementation or integration in operations is of little value.

Continuity of participation: There may be elements where participation can be difficult – sometimes experts are needed for specific complex assessments or engineers are needed to design new technical solutions, however, workers can be involved in identifying ideas for possible solutions and in the next phases of the process with testing and modifying solutions.

The methods and cases illustrate that there are different methods available; a few are designed to cover the whole process, such as ErgoPar (see section 2.2.2) and SOBANE (see section 2.2.3), but these extensive methods often require professional support and can be laborious for a small workplace. In such cases, the participatory cycle may help to consider all phases in dialogue with workers, such as in simple dialogue meetings. Particularly for risk assessment there are many methods available – some are easily used; others require experts' involvement. Yet, workers will in many cases be fully competent to participate in the risk assessment themselves, which will give the advantage of engaging workers from the very beginning and thereby increasing the chance for a positive outcome. Training in MSD hazards and risk assessment can facilitate strong participation of workers; however, their active involvement in risk assessment should not mean that the employer is delegating their legal duty to carry out a suitable and sufficient risk assessment.

Solution generation: At the other end of the phases there are also pitfalls, which can be avoided by a stronger participation of workers. Quite often solutions are implemented, but not integrated in operations or used in practice. New or adapted equipment is pushed aside and not used, and new work routines fade out as the old practice is reinstated. It is therefore crucial to consider testing, evaluation and

integration in the routines as part of the participatory process. Workers should systematically test and get the possibility to adapt solutions so they fit with work.

- **How much influence?**

Content and process: In the examples, the report has identified more cases where workers exert influence over the content of the participatory interventions than over the process. There may be several reasons for this. First, managers are likely to find structured frameworks under which workers can decide which aspects of work to improve more manageable compared to letting workers define the entire scope and process, or at least have a say in what will be looked at. And, knowing this structure in advance allows for better scheduling and balancing of intervention activities with production tasks. To fit the need for control, many external OSH professionals will more likely offer a series of pre-planned components that fit a structured framework.

The report has presented examples of worker participation processes that have been strongly guided by management. This entails a risk of staging a participatory process of workshops or other discussion methods, guided by a protocol containing only questions that management is interested in. The workers may have been heard, but their input does not change the direction of the strategy (Andersen, 2008). The conclusion is that management needs to be prepared to leave real influence to workers, and the consequence of real influence may be that workers have opinions or support solutions that are not necessarily in line with the preliminary management understanding.

Where teams are used, it is vital that the workers' participation in the team is genuine. This may be a challenge for very hierarchical organisations, and good quality facilitation may be needed to overcome this barrier. (Oakman et al., 2019).

Motivation to use their influence in decision-making: Worker participation requires involvement in democratic processes of dialogue, negotiation, consensus and decision-making, but not all workers want the responsibility that follows with the democratic process. Previous experience of being asked but not listened to will dampen their enthusiasm for a participatory process. If the workers' contributions are neglected or overruled by production priorities, costs, or the opinions voiced by persons higher up in the hierarchy, they will refrain from contributing (Hvid et al., 2020). The workers risk being labelled as 'reluctant to change' or lacking adaptability.

Previously, group consultations have been suggested for decision-making (Vvan Eerd et al., 2010), and in accordance with this, the report has identified several successful cases that have employed joint worker-manager steering committees or OSH committees. This seems to be a viable and balanced method as workers (or representatives) are involved in decision-making about hazards and potential solutions, while senior management has control over resources and to some extent implementation issues (Haines & Wilson, 1998).

- **When to involve?**

Tailoring to the circumstances: The easy answer is that workers should be involved in all phases of the preventive MSD efforts, but in practice that may be difficult. A mix of more and less participation in different phases, or combinations of direct and indirect participation, might be necessary. For instance, in many cases it would be an advantage for a successful outcome to already involve workers in the planning stages of the participation process.

Training to facilitate involvement: This report contains several examples of successful participatory processes starting with providing workers (representatives) with training in MSD prevention and OSH. The training adds to the professional development and autonomy of those who receive the training. When applied in a participatory context, the acquired new skills and knowledge further leads to knowledge sharing and development of joint team knowledge and collaboration in OSH. The training also fosters higher worker understanding of the participatory process and the link to MSDs, enhancing the potential for worker support. Both OSH training (ergonomics, risk assessment, MSD risk factors and prevention) and organisational training (depending on people's roles) are required for successful interventions (Van Eerd et al., 2010).

Dedicating resources to where participation will have most impact: Successful MSD interventions require sufficient resources for the entire process (Oakman et al., 2019). During a participatory process, it is of course also necessary to think of a rational application of resources so that the affected workers

are fully participating in the phases that are most important to them. In practice, this means creating teams with appropriate team members consisting of workers (or representatives) and other relevant stakeholders. It means involving the teams at appropriate times – be it change teams, workgroup teams, implementation teams and so on – and delegating responsibilities to the teams (Van Eerd et al., 2010).

- **How to organise?**

Appropriate level of project organisation: In this report, there are cases of participatory MSD prevention limited to solving a simple and tangible problem. In such cases, a formalised project organisation is of course not necessary, but in just slightly more complicated cases where risk assessment, solution generation and testing are the targets, some kind of a project organisation will be helpful. It will be more or less comprehensive, depending on the context, and it may (as outlined above) involve both a steering group and one or more working teams.

An important part is appointing a project leader, who oversees organisation of the participatory activities. Many workplaces tend to appoint the affected first-line manager or an OSH professional as project leader, but it would in many cases be relevant to consider (trained) workers in that role. Several methods include workers in roles as champions with responsibility to follow up on project activities; the advantage being that the participatory activities are embedded in the champions' team, leading to a greater chance of acceptance and support in the team. It is essential that the roles and responsibilities of all involved in a participatory intervention are clear (Oakman et al., 2019), including that of the project leader or champion.

A participatory culture: Sometimes participation can be used once to solve a specific MSD-related problem, and it can be useful for that specific purpose. However, the organisation is not necessarily equipped to solve future problems. It is therefore an advantage to make worker participation a goal in itself where the organisation (Abildgaard et al., 2020) continuously works to develop a participatory culture. In the analysed cases and examples, there are organisations with well-functioning OSH practices, where worker participation is easily employed and follows naturally in continuation of the existing work. Such an approach fits well with the strategy for continuous improvement employed by many organisations and can be integrated with, for instance, lean manufacturing methods such as kaizen and 5S. There are several ways to work towards integration in organisational culture. Prevention of MSDs as well as other health risks can be a regular item on the agenda at management meetings and discussions in the OSH committee. But perhaps the most useful strategy would be to utilise the experience from the participation efforts. The application of dialogue methods, project groups, solution testing, systematic evaluation and integration in operational routines all amount to experience that can be used to move towards a sustainable improvement culture.

Involving external support: The experience from the case studies and examples points towards the value of support from internal or external OSH professionals. However, the access to OSH professionals constitutes a challenge for most MSEs. They are too small to employ an internal OSH consultant, and paying for an external consultant is expensive. Yet, the case experience indicates some countries have systems that provide access to OSH professionals or other intermediaries, who can assist MSEs (see also Eurofound, 2010; Graveling & Giagloglou, 2020). The report has also identified networks for MSEs, such as employer organisations, trade associations or others, which organise events that introduce MSEs to simple methods of involving their workers in MSD prevention. Similar knowledge exchange networks have been identified for health ambassadors and for small companies collaborating to develop new technical solutions to counter workplace hazards.

7.3 Benefits of participation for health, productivity and quality

As pointed out above, there are great possibilities in the integration of a company strategy for continuous work improvements and a persistent focus on participatory MSD prevention. Both can support the other. More generally, the same counts for worker participation in prevention of MSDs and other health risks. The methods identified in this report are in the main generic and applicable to other types of OSH problems and health conditions. This means that embedding participatory processes in the existing organisational structures holds the potential to also address other health conditions like exhaustion or stress. By involving workers in improving their own health, they get valuable experience, which is an advantage for both health, productivity and quality.

Importantly, this report has identified how a participatory process seems to foster creative thinking and innovative ideas. The workers' commitment and engagement increase as they learn that their opinions and suggestions are valued by management and other stakeholders in the organisation. Worker participation thus taps into a valuable resource of workers' creative minds for improvements in OSH as well as production and quality. Innovation becomes a collective process that depends on the interaction of workers, their participation and involvement, the way the organisation is structured and the work is organised, the way internal decision-making and innovation processes are devised as well as blame-free and open organisational culture. If set up properly, workers will be more inclined to make more suggestions both about other health and production issues. Furthermore, such a development will make it easier to integrate production and OSH issues, which tend to be dissociated with safety and health pushed to the sideline (Hasle et al., 2021).

8 Conclusions

This report clearly demonstrates that there are good reasons for active worker participation in OSH prevention in general, and MSD prevention in particular, that goes beyond the formal requirement to consult with workers about OSH. This is in line with the findings of other authors (such as Oakman, 2019) and previous EU-OSHA reports (EU-OSHA, 2012a, 2012c and 2017). It is an approach that is good for both workers' health and for business. Active worker participation strengthens the possibility for identification of the most relevant health problems, for the generation of the best solutions and, not least, for sustained application of the solutions after implementation. It can be particularly helpful to find the simpler yet practical solutions to problems. In addition, positive experiences with participation in MSD prevention strengthens the workers' commitment and engagement in the workplace. The employers will therefore achieve an increased contribution from the workers in the daily work practices and in the continuous improvement of operations and MSD prevention.

While employers in the EU are required to consult workers and their representatives on health and safety (duties arising from the EU framework directive 89/391), this report emphasises the value of active worker participation that goes beyond the formal consultation requirement of the legislation for effective risk prevention.

A prerequisite for success is for management to be committed and to engage actively in the participatory process. More generally they need to create a workplace culture of open communication, where workers' opinions are valued, workers are listened to and what they say is acted upon.

In addition, for worker participation in MSD prevention to be effective, it cannot be limited to a single activity such as hazard spotting as part of risk assessment or solution generation. An identified MSD risk or a proposed improvement only helps if they are implemented in practice, tested and refined, and integrated in daily operations. The participatory efforts therefore need to consider the full risk management cycle, where all phases must be accomplished to secure a successful result, including monitoring and evaluation of implemented solutions.

Other important factors for success include allowing enough time for the participatory process, providing training if needed, for example in MSD risk assessment and in participatory processes and individual roles, and combining direct and representative participation as appropriate.

There are of course simple and easy-to-solve problems where the application of extensive process methods would be an overreaction, but even for the easy wins it is important to think about adjusting and sustaining the change. Furthermore, participation in MSD prevention is a continuous cyclic process where new problems require the introduction of new participatory processes. By adopting such a cyclic approach, workplaces can continuously move towards a more participatory culture.

The many different methods and the experience from the many practical examples indicate clearly that there is not just one road to efficient worker participation. There are many different ways. Methods and tools can be combined in various ways in the process of adapting to the particular context of the workplace. Factors such as sector and composition of the workforce (gender, skilled/unskilled, ethnicity and others) are all important to fit the particular participatory process to the workplace. In particular, MSEs need adaptation to their particular context with limited resources in the form of management and time. The report therefore suggests how to adapt many methods to a simpler and straightforward approach which can function in MSEs.

In summary, the key success factors include the following:

- Management commitment at all levels and active engagement;
- Adequate time and resources;
- Training about MSDs/ergonomics, risk assessment and prevention, and participatory methods;
- Workers actively involved at all stages of the intervention, from planning to evaluation, and all relevant stakeholders included;
- Effective communication;
- Embedding improved participation from one intervention into continuous MSD management.

8.1 Policy pointers

Even though active worker participation in MSD prevention offers strong advantages for both workers and employers, this strategy needs active support from governments, social partners and OSH organisations for it to happen in the first place and for it to be effective. The results of this report and previous EU-OSHA reports (EU-OSHA, 2012a; 2012c; 2017) suggest several policy pointers.

- **1. Further development of rules and guidelines for worker participation**

EU minimum legal requirements for worker involvement can in practice be limited to formal consultation without active participation in hazard and solution identification and involvement in decision-making. As active participation is most effective, it would be beneficial for authorities and the social partners to agree on rules and guidelines adapted to sectors and different-sized organisations for active participation. Such rules and guidelines can help companies to move from formal consultation to effective worker participation, where representative and direct participation are combined as appropriate. There is a special need for the rules and guidelines to facilitate participation of all workers such as vulnerable workers (emigrants and temporary workers in the gig economy) and both genders. For implementation of new rules as well as the existing ones, it would be an advantage to include worker participation in labour inspectors' guidance and enforcement. The development of rules and guidelines should be combined with awareness-raising about the importance of active worker participation.

- **2. Creating support systems**

The experience from the many practical cases as well as the advice in many of the participatory methods indicate that professional support is important and sometimes a prerequisite for a successful outcome. Support can take many forms, but it is important that support systems be adapted to the national and sector context. Such systems do not exist in all EU Member States and for all relevant sectors, and expansion of professional support with a focus on assistance to develop participatory competences in companies would therefore be important for more effective worker participation.

- **3. Training in participation**

Many cases and methods show that training for manages and workers in their roles and MSD hazards and their prevention is important, but also that introductory training in participatory methods is important for the outcome. Some countries and some sectors provide such training, but it is far from all workers and companies that have access to this type of training. Much of the available training focuses on MSD and OSH content and less on the participatory elements. There is therefore a need both to expand the training availability in many countries and to increase training in facilitating participation as such. By doing so, companies will also strengthen their competence to run participatory processes. Another important aspect is training of OSH professionals and labour inspectors. They can, in many cases, also benefit from increased education in participatory processes, for example to support labour inspectors to promote worker participation during their inspections and investigations.

- **4. Intermediaries to support the special needs of MSE**

Micro and small enterprises are in many ways more vulnerable than larger enterprises. They have less power on the market and few resources in terms of both management capacity and human resources. They therefore have difficulties in securing safety and health of workers including protection against MSDs. The most efficient support to the special needs of MSEs takes place through intermediaries (Hasle et al., 2017), who can be employer and trade associations, labour unions, labour inspectors, OSH advisory services, insurance companies and others. Practical support for interventions (such as provision of training or steering and intervention) and economic support are relevant as MSEs generally do not have resources to pay for market-based OSH consultancies. An effective way can be to support groups of MSEs from a sector at the same time – allowing MSEs to learn from each other. It is important that the necessary regulatory requirements are in place to provide a framework for participation as well.

- **5. Funding is necessary**

While stakeholders can initiate activities to support worker participation in MSD prevention, funding is important to achieve large-scale progress. Available EU transnational funding schemes can be used to develop and transfer programmes and initiatives on worker involvement between Member States, but additional national and EU funding would be a valuable asset for progress in worker participation.

6. Further research

Further research is needed concerning: the prerequisites for effective worker representation and participation; effective participatory methods that MSEs can apply themselves; and how worker involvement could be achieved in new types of work, for example in the gig economy and among vulnerable groups of workers. Existing good practices need to be shared between organisations and between Member States.

Annex 1 Legal requirements on worker consultation in occupational safety and health

The legislation on occupational safety and health recognises the importance of involving workers in occupational safety and health. Employers have a legal duty to protect their workers and to consult with them about developing safe systems of work. In order to do this effectively, they need to establish arrangements that allow and encourage workers and their representatives to participate in decisions about managing safety and health at work. European legislation lays out basic requirements on information for workers and consultation. National laws and/or practices set the specific requirements on information provision and consultation, especially regarding worker representatives and their rights and the establishment and use of forums such as joint management–worker safety committees, and the involvement of works councils (see Eurofound, 2010 for some examples).

Minimum requirements on worker consultation, participation and training set in the EU 'OSH Framework' Directive 89/391 (EU-OSHA, 2021b)

- Employers must inform workers and/or their representatives of the risks involved and the measures to be taken.
- Employers must train their workers and provide fresh training whenever there is a recruitment or change of job.
- Employers must consult workers and/or their representatives and allow them to take part in discussions on all questions relating to safety and health at work, respecting their right to make proposals and organising their balanced participation.
- The issues on which consultation must take place, in advance and in good time, are:
    - any measure which may substantially affect safety and health;
    - the designation of workers responsible for OSH activities, and first aid, fire and evacuation activities and the enlistment of outside competent services;
    - the information the employer has to provide workers relating to risk assessment and groups of workers exposed to particular risks, including consultation on: protective measures to be taken, including the provision of personal protective equipment, details of occupational injuries;
    - the planning and organisation of health and safety training for workers;
    - the planning and introduction of new technologies.
- Workers/workers' representatives have the right to ask the employer to take appropriate measures and to submit proposals.
- Employers must allow workers' representatives with specific responsibility for the safety and health of workers adequate time off work, without loss of pay, and provide them with the necessary means to perform their functions.
- Workers' representatives must be given the opportunity to submit their observations during inspection visits by the competent authority (such as labour inspectors).
- Workers/worker representatives may appeal to the competent authority (such as the labour inspectorate) if they feel that health and safety in their workplace is inadequate.
- Worker representatives with safety responsibilities are entitled to appropriate training.
- Employers must give worker representatives with safety responsibilities access to all the information necessary for a proper evaluation of risks within the enterprise and to the accident reports drawn up for submission to the competent member state health and safety authority.

NB: National laws and/or practices set specific requirements on information provision and consultation. According to EU-OSHA (2012b), using a combination of arrangements and methods, both formal and informal, is usually best. In particular, direct worker participation and worker representatives should not be seen as alternatives, but as different avenues to be combined as effectively as possible.

Annex 2 Research methods

Methodology for the identification of participatory methods and short examples of the use of participatory methods

Aims

The aims of task 1 were to:

- Provide information and guidance on practical approaches, methods and techniques to actively involve workers in joint identification and solving of MSD problems, including approaches relevant to MSEs, on what employers can do in practice (task 1A);
- Identify and present short examples of MSD interventions and the participation methods used in them (task 1B).

General approach

We conducted systematic searches of scientific and grey literature and conference proceedings on examples describing worker participation in MSD prevention. In addition, we sought unpublished examples from the EU-OSHA focal points, supplemented with searches in the scientific literature on participatory frameworks, reviews and theories and did internet searches from good practice providers and OSH organisations.

First, we identified examples of worker participation in MSD prevention (task 1B). Next, we used the identified short examples as a basis for designing a typology of participatory approaches and methods and presented practical examples (task 1A).

Literature searches

Scientific and grey literature

A systematic search of the following databases was undertaken: MEDLINE, Web of Science, Scopus, and Business Source Complete. All databases were searched from 2010 until 5 November 2020. The searches were performed by an experienced search specialist at University of Southern Denmark (SDU) with content expertise in OHS. The search strategy included subject indexing terms and free-text terms for title, abstract and keyword searching. The search terms were grouped into four concepts: 1) MSD, 2) workplace settings, 3) participation, and 4) ergonomy. The search terms were selected with reference to the participatory ergonomics framework, previous reviews of participatory ergonomics and worker participation and after discussion with the review team. The full version of the search terms used, including specifications on use of title, keywords, or abstract screening, is documented for the example of Business Source Complete in table I.

The ‘grey’ databases do not contain advanced search possibilities. Therefore, we performed several shorter searches with few key words describing the research question in: Greylitt.org, OpenGrey, Google Scholar, and Proquest Dissertations & Theses Global. In addition, we scrutinised previous EU-OSHA publications for relevant examples.

Table I. Search strategy in Business Source Complete

Search strategy - Business Source Complete	
MSD	“back pain” or “musculoskeletal pain” or “neck pain” OR “Muscle Fatigue” OR " Occupational Diseases " OR TI "pain*" or muscle pain* OR muscle soreness* OR musculoskeletal pain* OR myalgia OR "chronic pain" OR musculoskeletal disorder* OR Musculoskeletal disease* OR “musculoskeletal disorder*” OR “shoulder pain*” OR “forearm pain” or “wrist pain” OR “elbow pain*” OR “hip pain*” OR “knee pain*” OR “ankle pain*” OR “muscle disease” OR (DE "CARPAL tunnel syndrome") OR “carpal tunnel syndrome” OR “repetitive strain injur*” OR (DE "OVERUSE injuries") OR “overuse injur*” OR (DE "SICK leave") OR "Sick Leave" OR "sick listed" OR (sickness N3 absence) OR (DE "JOB absenteeism") OR absenteeism OR (DE "WORKERS' compensation") OR "workers' compensation" OR (DE "JOB performance") OR "work performance" OR (DE "INDUSTRIAL productivity") OR “work efficiency”/ OR (DE "LABOUR productivity") OR “work productivit*”
AND	
Workplace settings	Workplace* OR DE "SMALL business" OR ((small or "medium-sized" or micro) N3 (business or businesses or enterprise or enterprises or company or companies or factory or factories or office or offices)) OR DE "INDUSTRIAL hygiene" OR “Occupational Health” OR DE "WORK environment" OR "work* environment" OR DE "INDUSTRIAL safety" OR (health N3 safety)
AND	
Participation	((engagement or involvement or participation OR consultation OR representation) N3 work) OR DE "INDUSTRIAL safety" OR "codetermination" OR "co-determination" OR "knowledge transfer and exchange"
AND	
Ergonomy	((DE "ERGONOMICS") OR (DE "TASK performance")) OR (DE "PARTICIPATORY economics") OR ergonom* OR "task performance and analysis"
AND	
Limits	(yr="2010 -Current" and (danish or english or estonian or french or german or norwegian or swedish))

Search of ergonomic conference proceedings

We searched conference proceedings from six international conferences: International Ergonomics Association (IEA) Congress in Florence, Italy in 2018; International Conference on the Prevention of Work-Related Musculoskeletal Disorders (PREMUS) in Bologna, Italy in 2019; 50th Nordic Human Factors and Ergonomics Society (NES) conference, in Elsinore, Denmark in 2019; Society Ergonomics in French Language (SELF) conference in Tours, France in 2019; Work Disability Prevention and Integration (WDPI) conference in Odense, Denmark in 2019; Organisational Design and Management (ODAM) conference in Nottingham, UK in 2020. Identified examples were tracked in scientific databases for full reports.

Contact to key European stakeholders and solicitation of international scientific networks.

To ensure coverage of the EU countries and that all relevant examples were identified, we supplemented the scientific literature with examples from the EU-OSHA focal points. In collaboration with EU-OSHA, we contacted the 23 focal points and asked for examples from their countries.

Finally, the senior researchers reached out to their personal scientific networks to ask for unidentified examples.

Supplementary searches for good practice examples

In task 1A, we supplemented the identified short examples (task 1B) with searches in the scientific literature on participatory frameworks, reviews and theories, and internet searches on good practice providers and OSH organisations.

Study selection

All identified scientific citations were uploaded to Covidence software (Covidence.org). An integrated duplication detection tool was used to identify duplicates. All suggested duplicate pairs were screened for correctness by one reviewer. Title and abstract screening was performed for each article by two independent reviewers of six. Disagreement between the two reviewers resulted in inclusion of the citation to full-text screening. Full-text screening was similarly performed by two independent reviewers of eight, assessing the eligibility of the citation. Any disagreement was resolved through discussion mediated by a third reviewer of two. The eligibility criteria are outlined in table II.

Table II. Eligibility criteria

Inclusion criteria	Exclusion criteria
Participants: Employed workers Aged 18-67	**Participants:** Workers on sick leave Not in employment Self-employed workers
Health problems: Any MSD	**Health problems:** Non-MSD General health promotion
Settings: Workplaces of any size	**Settings:** Not workplace-based The home as a workplace (Occupational) health care settings
Workplace Participation: Any type of empirical study describing the involvement of workers in OSH. Direct involvement Representation (elected, appointed) Mixed Any timing of the involvement Risk assessment Designing and planning Execution or implementation Evaluation	**Workplace Participation:** Non-participatory studies: Surveys conducted by researchers/management with the singular aim of identifying the prevalence of health or work-related problems Risk assessments/observations of workers performed by researchers, managers or OSH professionals Descriptions of risk assessment tools that do not include empirical data
Prevention of MSD: Prevention of onset of MSD (primary prevention) Prevention of consequences of MSD (secondary prevention)	**Prevention of MSD:** Studies or interventions focusing on return to work of workers on sick leave Slips, trips and falls General health promotion studies
Study designs – task 1B: Any study with original empirical data (qualitative, quantitative or mixed methods) Any language Published year 2010 and later **Study designs – task 1A:** Reviews, theoretical pieces, editorials, comments, opinions were excluded from task 1B, but contained for task 1A	

Data collection

Prior to the data collection, data extraction sheets were piloted and revised. The content was tailored to the focus of the review. Data extraction was performed independently by one of seven reviewers using the data extraction sheets and reviewed by a second reviewer of eight. Discrepancies in extracted data were considered by a third reviewer of two by revisiting the original paper to adjudicate on appropriateness and discussed and finalized where required.

Unpublished examples from the EU-OSHA focal points were assessed by one reviewer with sufficient language skills to assess the content and relevance of the example and extract the data. If needed, supplementary electronic interviews (e-mail correspondence and teleconference) were conducted to collect information on potentially relevant examples.

Identification of participatory methods

Data was systematically extracted on:

- The aim and approach of the method;
- How to apply the method, including procedures, resources and facilitating factors;
- Level/type of participation;
- Information about where the method has been used.

Each method was assessed for its usefulness, its strengths and weaknesses, and the relevance to or how to adapt it for MSEs.

Identification of short examples of the use of participatory methods

Data was systematically extracted on:

- Publication data: author, title, date, publication source;
- Setting: country, sector/industry, size of company/workplace;
- Study characteristics: design, inclusion/exclusion criteria, recruitment and participation numbers;
- Study population: age, gender, ethnicity, duration of symptoms, comorbidities, key work tasks/hazards;
- Intervention/change process characteristics: key components (such as preventive measures), characteristics, and underlying theoretical concepts;
- Outcome measures/health effects: Primary and secondary outcomes, time-points for outcome assessment, effects, attrition rates and sustainability of effects.

In addition, the examples were assessed using two scales: *Relevance to MSEs* and *Level of Participation.*

Relevance to MSEs

The relevance to MSE scale describes the fit of the participatory approach with existing MSE structures and capabilities. Relevance for MSEs is assessed using a 3-point categorical scale: low – moderate – high relevance. The following criteria were applied (see table III).

Level of participation

This scale describes the workers level of influence over the content of the intervention activities, such as the goal of the activities and what areas of work are targeted. Level of participation is assessed using a 3-point categorical scale: low/informative level – moderate/consultative level – high/delegative participation. The following criteria were applied (see table IV).

Table III. Criteria for judging relevance for MSE

Relevance for MSE - Criteria		
Low relevance	**Moderate relevance**	**High relevance**
High cost (resources, i.e. time, material, personnel) for employer	Medium cost	Low cost (resources, i.e. time, material, personnel) for employer
Requires 2 or more external consultants, OSH professionals or other external intermediaries	Requires a single external consultant, OHS professional or other external intermediary	No or limited involvement of external consultants
Requires specialist training and/or skill	Requires limited specialist training and/or skills	Requires no or low level of training/education to implement
Requires specialized, not readily available equipment	Limited use of specialized equipment	No use of specialized equipment
Manual/description are not readily available	Limited availability of manuals or description	Ready to use manuals or descriptions of actions available, including information material to workers
No trusted, personal support available for employers/workers	Limited trusted, personal support available for employers/workers	Trusted, personal support available for employers/workers
Changes difficult to implement and poor fit with production goals	Changes with moderate fit to production goal	Easy changes to implement (i.e. 'low hanging fruits') that fit with production goals

Table IV. Criteria for assessing level of participation

Level of participation - Criteria		
Low/informative	**Moderate/consultative**	**High/delegative**
Participation serves as an implementation tool, only marginal adaptation allowed No or marginal influence over content, target areas or activities	Some predefined content Some predefined suggestions workers can prioritize or choose from	No restrictions on the working areas or tasks targeted or activities developed Problem identification and prioritization by workers Solutions identified and prioritized by workers Implementation strategies identified and prioritized by workers

Data synthesis

Task 1A – development of the typology and presentation of practice examples of worker participation approaches and methods

As a starting point for the typology, we conducted an initial search for descriptions of participatory ergonomics and previous reviews on the subject matter. The point of departure was the short examples from task 1B and EU-OSHA website and reports, which was for relevant material. Further, references from the authors' personal libraries and relevant material identified in the literature searches was included. Through a process of iterative review of material, we drafted the typology, which represents a standard format for reporting of practice examples of methods and approaches. It builds on the body of research in participatory ergonomics, the broader field of workplace prevention and participation, and

socio-technique. The practice examples of worker participation and approaches were synthesised narratively in accordance to the typology.

Task 1B – short examples of MSD intervention using worker participation

The short examples were selected based on a combination of the aim to secure a wide scope and simplicity to apply, especially in micro and small enterprises (MSEs), while at the same time securing as strong a worker participation as possible.

The short examples were narratively described by sector (EU NACE, revision 2, Statistical Classification of Economic Activities in the European Community), and the assessments of relevance to MSEs and level of participation were graphically displayed. Quantitative results from outcomes reported in the examples were described as either favouring the participatory intervention group or not being effective.

Results of the literature searches and solicitation of stakeholders

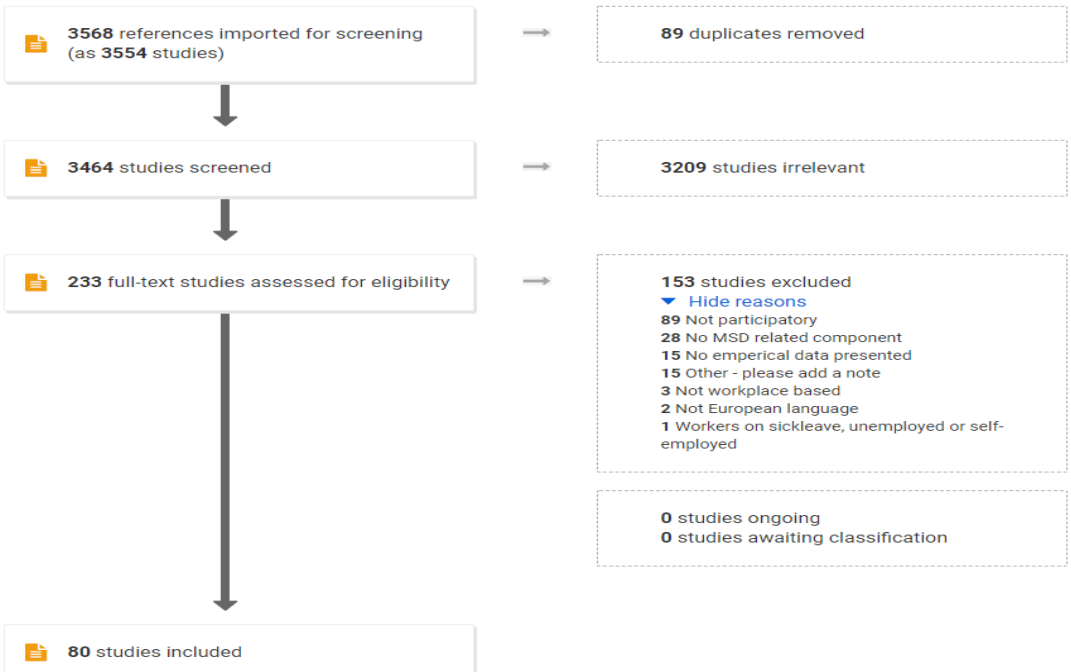
We identified a total of 3,568 references in the four scientific databases (2,994 references) and four grey literature databases (574 references) (figure I). The references were transferred to Covidence and screened initially by title and abstracts. After title abstract screening 233 titles remained for full-text screening of which 153 were excluded with reasons. Eighty titles were included for data extraction. We identified approximately 1,700 conference abstracts, resulting in 85 titles that underwent full text scrutiny.

We supplemented the scientific literature searches with examples from six previous EU-OSHA reports and seven unpublished cases.

We contacted 23 EU focal points and personal research networks and received positive responses from Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, Latvia, Norway, Slovenia, Spain, Sweden and USA.

Ultimately, we included 55 examples. These were identified in the scientific and grey literature (28), through the EU focal points (18), and EU-OSHA cases (9). Of these, 5 examples were selected for a detailed presentation (task 2).

Figure I Flow chart of inclusion of literature



Source: Covidence

Methodology for the case studies

Aims

The aims of task 2 were to:

- Provide an in-depth exploration of how workplaces may successfully involve workers in active and joint problem-solving for MSD problems using five case studies;
- Provide lessons for the wider implementation of good practice for worker participation in micro and small enterprises.

General approach

We used qualitative methods to explore how micro and small sized workplaces may actively involve workers in MSD prevention and the mechanism by which successful outcomes were achieved.

The analytic approach leaned on realist evaluation and the Context-Mechanism-Outcome Configurations (CMOs) Model (Greenhalgh et al., 2015; Pawson & Tilley, 1997). The CMOs model is a basic causal explanatory framework for realist evaluations. The fundamental idea is that by comparing cases, it is possible to identify the mechanisms, which may create successful interventions and thereby answer the question: 'What works for whom under what circumstances?' Therefore, the output of a realist evaluation is a description of: 'In this context, this mechanism is likely to generate this outcome.' With such answers the analysis opens possibilities to transfer the learning from the analysed cases to application in another context and thereby pinpoint success factors, challenges/barriers as well as innovative features.

We started by developing a programme theory based on the standard participatory ergonomist approach and supplemented with implementation theory. We subsequently studied whether the theory was supported by the case studies and whether there were additional mechanism/context not studied. In the analysis and presentation of the cases, the focus was on highlighting the features, which make worker participations successful. We focused on two aspects in particular:

- How does the workplace context influence the actions taken by workplace actors when undertaking participatory processes?
- How do workplace actors' actions in different contexts influence worker participation?

Furthermore, the contexts of the cases were described in detail to provide an understanding of the conditions that facilitate successful worker participation. Other foci included the perception of workers, including their experience of the participatory processes, the mechanisms by which workers are working together with management on achieving outcomes, and facilitating and constraining factors regarding uptake, implementation and longevity of the participatory programs.

Chapter 4 concludes with a cross-case analysis. Here we presented the general learnings, which could be drawn from the cases as well as supporting evidence from the methods, approaches and short descriptions of cases in chapter 2 and 3. The cross-case analysis explored the following:

Our analysis of the context, the actions and participatory outcomes identified across nine cases resulted in five overall principles for worker participation in MSD prevention. These principles were further specified in 13 concrete conditions an MSE should consider when engaging in worker participation in MSD prevention. For each principle, we have written a short description of the core of the principles, which is followed by a description of the conditions; each of them with examples and arguments drawn from the cases found in the preceding part of this chapter. Table 5 gives an overview of which cases have contributed to the 13 conditions.

Case selection, data collection and case descriptions

The authors of the report used a funnel process to narrow down a list of potential cases to five. Our point of departure was the database of cases, the typology and assessment scales produced in task 1. If the case studies had been identified by the EU focal point contacts in task 1, we reached out to the contact person a second time and asked specific questions about the cases. In addition, EU-OSHA provided four cases. Totally, nine cases were selected and analysed.

The study material included:

- Primary written material, i.e. scientific publications and evaluation reports in relation to the case;
- Interviews with 1-3 stakeholders per case (not including the EU-OSHA cases);
- Collection of additional material (as needed), including instructions, internal company material documents, any audio-visual material available and relevant administrative data.

Written material

Based on the written documentation of the case, we drafted the detailed case descriptions. The content of the written material covered most of the case contexts, participatory approach, and barriers and facilitators. A template, instructions and an example were available for the detailed case description.

Stakeholder interviews

Depending on the extent and quality of written materials, we conducted supplementary digital interviews with 1-3 selected persons. As the written material was expected to cover OSH professionals' and managements' experiences and views, while worker experience was likely to be more limited, special priority was be given to interviews with worker representatives to gain a more multifaceted understanding.

We conducted digital interviews using online video conference systems, telephone interview and email correspondence with interviewees following a pre-specified, iterative interview guide. Choice of interview method was that preferred by the interviewee at a time most convenient for them. The interviews followed a generic, semi-structured interview guide with prompts to help focus the interviews. Verbal interviews were audio recorded.

Data analysis

Consistent with the realist approach, data analysis was retroductive in that it applied both inductive and deductive logic to multiple data sources, while also incorporating the project team's own understanding to identify conditions that impact worker participation.

Data analysis was performed with triangulation of data sources. Triangulation refers to the application and combination of several research methods and sources in the study of the cases. By combining multiple methods and materials, triangulation minimizes the risk of intrinsic biases.

As a first step, the individual consortium teams familiarised themselves with the collected material to get a better contextual understanding. Next, data was coded openly to get a thorough understanding of all the data. Second, the open codes were categorised into higher-level analytical categories. Building on the coding strategy, we used the analytical approach of displays to draw conclusions within and across the cases.

In the cross-cases analysis, we searched for commonalities across the case study findings. This included combination and comparison of CMOs across case studies. Finally, the CMOs and their supporting evidence from the cases were collated into tables organised under their resulting conditions for worker participation in MSD prevention.

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Annex 4 Effective worker participation checklists

The following two checklists, taken from EU-OSHA (2012b), cover the key points that should be considered when developing arrangements to improve worker involvement. The first checklist covers workers and the second covers workers' representatives. They are not exhaustive and should only be considered as guides that cover the main points.

	WORKERS
1	Are workers consulted about and involved in the risk assessment process related to their work?
2	Have workers been trained to understand how the general principles of prevention are applied to develop health and safety measures?
3	Are workers encouraged to propose ideas for improving health and safety standards?
4	Are workers trained to report hazards and any defects in the employer's arrangements to protect people?
5	Are workers consulted about and involved in the drafting of instructions, procedures, policies, etc.?
6	When changes are planned are workers consulted and involved before the final measures are adopted?
7	Are workers trained to be proactive in looking for improvements in arrangements for health and safety?
8	Are workers consulted about and involved in the selection of tools, work equipment and Personal Protective Equipment before such items are bought?
9	Are solutions 'trialled' with workers to get their feedback before final decisions are made?

	WORKER REPRESENTATIVES
1	Are there agreed procedures for the participation of worker representatives?
2	Are worker representatives consulted about all questions relating to health and safety, including: risk assessments, measures, the designation of workers responsible for health and safety, first aid, health and safety training, introduction of new equipment, technologies, etc.?
3	Are worker representatives consulted about and involved in the drafting of instructions, procedures, policies, etc.?
4	Are worker representatives involved in making decisions about health and safety, e.g. via advisory bodies and decision-making groups?
5	Do health and safety audits actively include safety representatives as well as managers?
6	Are worker representatives encouraged to report case studies of good practice, which could be stored in an organisational database?
7	Are worker representatives fully involved in the investigation of incidents?
8	Are worker representatives permitted paid time off work to discuss matters and provide feedback to the workers they represent?
9	Are worker representatives provided with administrational assistance to support them fully in carrying out their functions?
10	Are worker representatives properly trained in general principles of prevention and application of principles at the workplace? Have they been trained to develop their representative skills?

Annex 5 Brainstorming ideas for actions

A brainstorming session where everyone puts forward options and ideas for actions to prevent MSD risks is a good way of involving workers in the process and allows them to put forward their own ideas. All workers who are involved in an MSD project should be part of the brainstorming session. One way of structuring the session would be to ask workers to suggest actions targeting the workplace environment and layout, the equipment, the work processes and organisation, the materials, psychosocial factors or the workers (such as training). The group can then consider whether actions are required at all these levels or not. Some issues might require a combination of actions targeting several factors, whereas others could be addressed with only one minor change.

Brainstorming can be helped by providing participants with a list of tips for managing risk factors and examples of solutions (see examples of solutions in OHSCO, 2010 and ILO, 2010). If agreement on the root causes and solutions is not reached, an in-depth risk assessment may be needed.

The Occupational Health and Safety Council of Ontario (OHSCO) provides a 'Developing Solutions Worksheet for MSD Risks' covering the different areas of action. The points to consider are just examples:

Developing solutions worksheet – examples of points to consider

<table>
<tr>
<td>Work processes and organisation, e.g.:

▪ Self-paced tasks, cycle time allows for micro-breaks
▪ Job enlargement and/or task rotation
▪ Improve work/material flow
▪ Improve communication between workers performing task
▪ Improve communication between workers on adjacent tasks
▪ Improve communication between workers and production, quality, planning, engineering, etc. departments
▪ Timely response to reports of defects, equipment breakdown, product/tool/ equipment damage
▪ Adequate staffing levels for workloads</td>
<td>Workplace environment/ layout, e.g.:

▪ Organise workstations to enhance interactions
▪ Redesign workstation layout to provide space for movement and required job tasks
▪ Improve housekeeping
▪ Ensure comfortable working temperature
▪ Provide anti-fatigue matting</td>
<td>Work materials, e.g.:

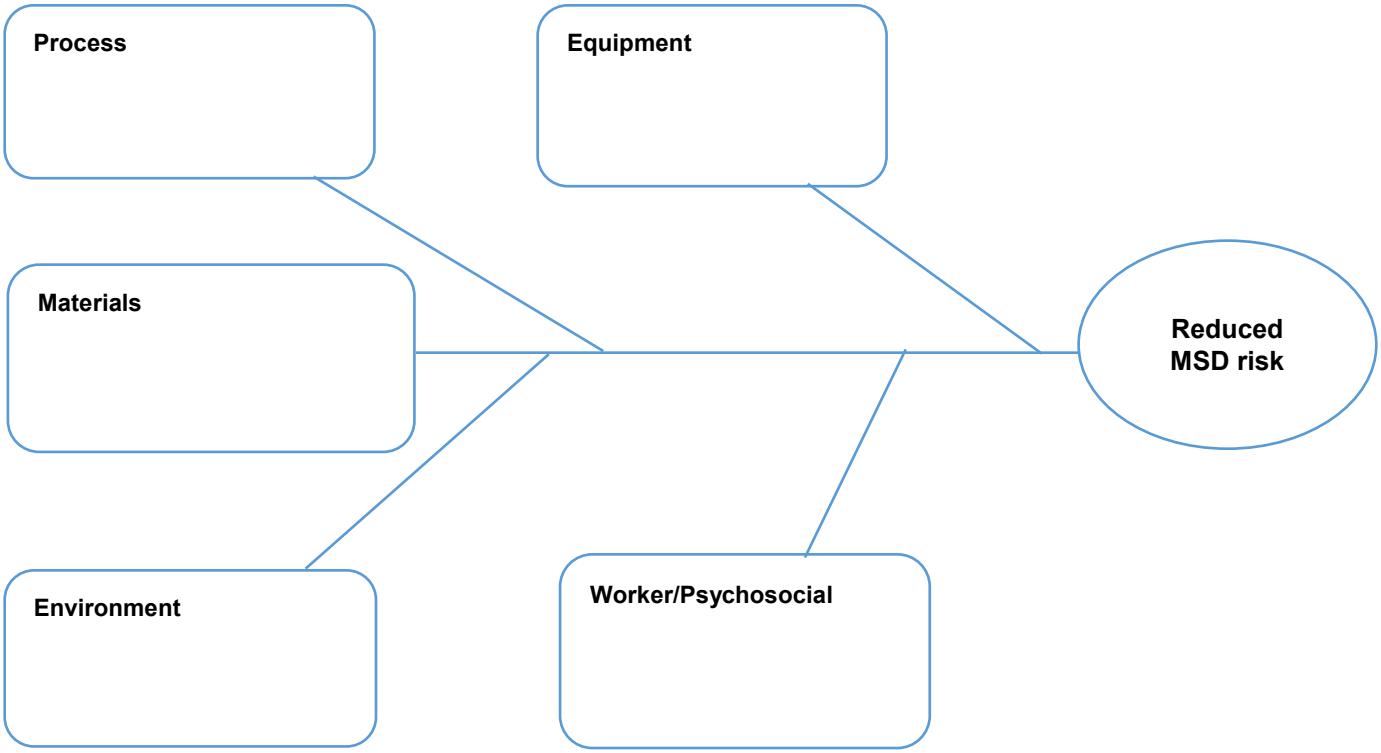
▪ Organise stock on shelves taking weights into consideration
▪ Reduce frequency of substandard/ poor quality materials
▪ Purchase in manageable weights/sizes
▪ Purchase materials in bulk containers
▪ Redesign packaging to include handles
▪ Store materials in areas that are easy to access</td>
</tr>
<tr>
<td colspan="2">Equipment, e.g.:

▪ Mechanise a process
▪ Provide mechanical lifts, hoists, conveyors, motorised carts
▪ Improve workstation design/layout
▪ Workstation adjustability (sit/stand, height adjustable)
▪ Preventative maintenance
▪ Pre-shift checklist/inspections
▪ Move control, displays, tools for easier use, visibility, access
▪ Make sure controls are properly labelled/colour coded
▪ Provide space for workers to move, allow unconstrained postures
▪ Provide material handling equipment for moving materials</td>
<td>Worker and psychosocial factors, e.g.:

▪ Training including:
○ Signs and symptoms of MSD
○ MSD hazard awareness
○ How to report MSDs/MSD hazards
○ Work techniques and processes
▪ Team-based solutions/participatory problem-solving
▪ Reinforce need for use of equipment/controls that help reduce MSD risk
▪ Improve communication/support from supervisors
▪ Support for early reporting of concerns
▪ Personal protective equipment (insoles, knee pads, anti-vibration gloves)
▪ Stress factors including:
○ Production pressures and demands
○ Clear task demands</td>
</tr>
</table>

Source: Occupational Health and Safety Council of Ontario (OHSCO). MSD Prevention toolbox part 3A – getting started. Available at: https://www.iwh.on.ca/sites/iwh/files/iwh/tools/msd_prevention_toolbox_3a_2007.pdf

Annex 6 Developing solutions worksheet – template to map out the solutions



Source: Occupational Health and Safety Council of Ontario (OHSCO). MSD Prevention toolbox part 3A – getting started. Available at: https://www.iwh.on.ca/sites/iwh/files/iwh/tools/msd_prevention_toolbox_3a_2007.pdf

Annex 7 Action plan template

This is an example of an action plan template that is used for documenting problems and identified risks.

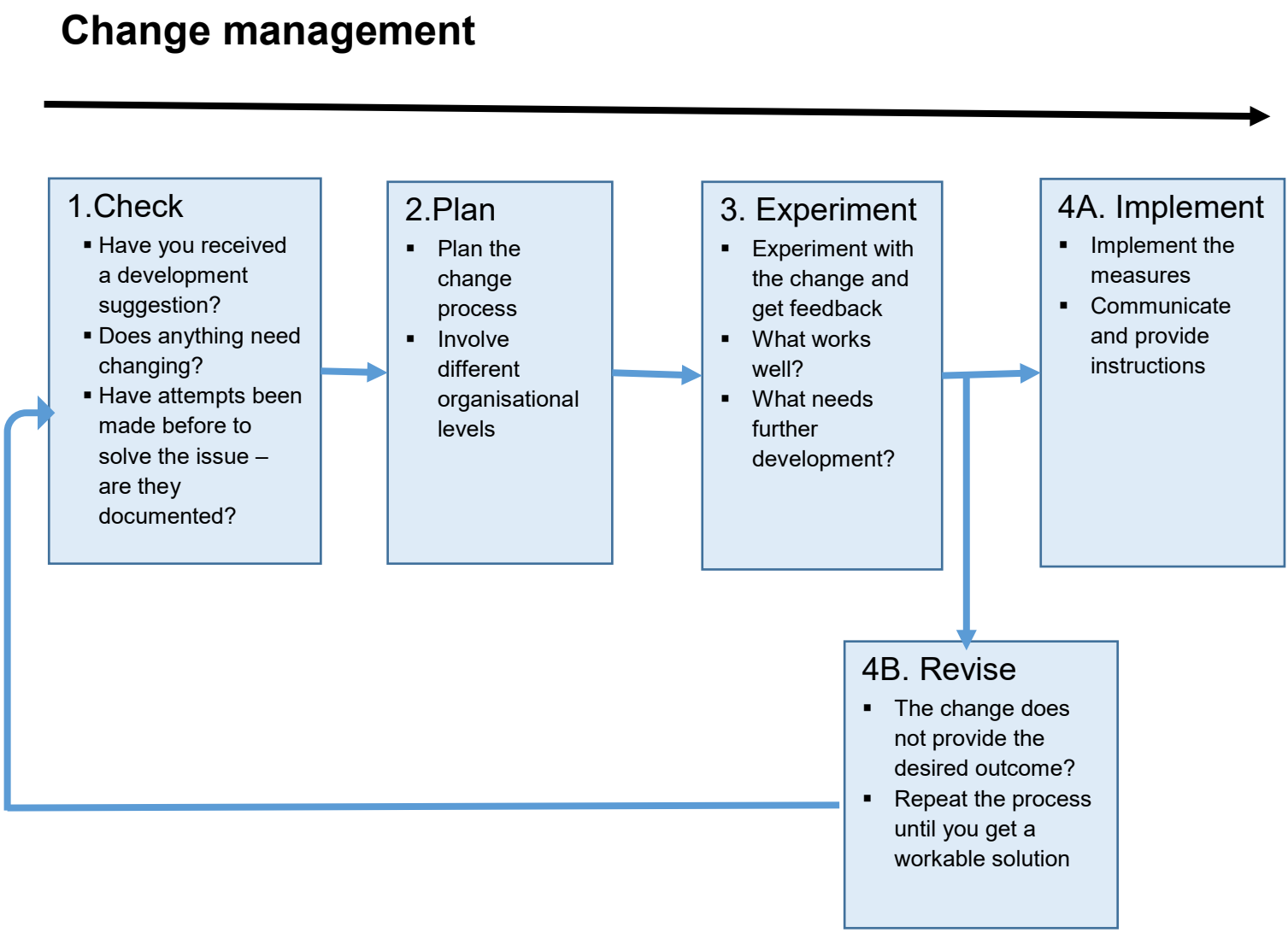
Hazard/risk/ problem	Priority	Actions/ Solutions	Responsibility/Those involved	Budget/ Resources	Deadline/ Timeline	Evaluation

Annex 8 Change management using the continuous development model

The figure below shows a continuous development model. It starts from a situation where the organisation has identified a need to change or develop something related to work or the work environment. It works thorough encouraging a culture of rapid experimentation at workplaces where everyone working in the organisation participates in making observations on development needs. Solutions for identified needs are sought by testing and modelling. A rapid experiment initially started on a small scale can later be expanded into a pilot project. The approach is based on continuous process of experimentation, feedback and revision until a suitable solution is found. The approach is based on lean methodology, which is a way of optimising the people, resources, effort and energy of an organisation using the guiding principles of continuous improvement and respect for people.

The model is based on Halmeenmäki and Myrsky, a publication commissioned by the Ministry of Social Affairs and Health, Finland (2021).

Generic process for continuous development adapted from lean methodology



Source: Adapted from Halmeenmäki and Myrsky, commissioned by the Ministry of Social Affairs and Health, Finland (2021)

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